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LETTERS

From the Hamshack

Laci W1PL, Melrose MA Wayne, it was great to meet you and even more so to hear you talking to the New England DX people about the problems, the negative effects of the pursuit of the ARRL DXCC as it happens today. This problem bothered me also for a long time, discussed it with a few close friends, but we felt incapable and utterly powerless to even try to do anything about it.

You have proven so often that you see the future of amateur radio way ahead of the rest of us. It seems to me, the DXCC problems must be solved in some reasonable manner to keep it desirable, obtainable, and alive at all.

I know it is very difficult to change anything, but it could be done, I think, if valid DXCC credits would be given for QSOs worked only during the world's main contests, CQWW, ARRL DX, WAE, and AA. This would increase participation in the contests, concentrate the DXpeditions in those time frames, and would eliminate the discouraging, alienating effect of so many pileups with all the annoyances. The general ham population would enjoy operating in a more quiet atmosphere (ionosphere?). Even the rare DX stations would be free of that aggressive calling-hysteria, which chases the rare DX operator off the bands.

Immediately after the war, when I was practically the only HA station on the air, I lived quite a few years under the pressures of a rare DX. It was a bit easier than today, due to the lower powers, fewer beam antennas, and (may I say so?) snappier operators and more gentlemen. It still was often too much to take.

I leave my idea now with you, and please continue working for amateur radio's better future.

Thanks for your nice letter. I was wondering what impact my talk might have on the DXCC brethren. I had to get back, so I didn't hang around to see whether they would arrange a monument or tar and feathers.

One added benefit, as you mentioned . . . contest contacts would eliminate most of the QSL problems since they'd all be handled by computer.

Laci, I've changed amateur radio a good deal, so maybe I can do some more. I'm trying.

If I remember well, our first QSO happened 43 years ago! Hi! . . . Wayne

Kent Phillips WB8HWO, New York NY Wanted you to know *73* has followed me everywhere in the Middle East, and without your refreshing comments life would be rather dull. Keep up the satire only worthy of "Uncle Wayne." Please enter me in Ham-It-Up Sweepstakes; I'm only 6,000 miles from my nearest dealer.

Steve Katz WB2WIK/6, Canoga Park CA I've been following your "Never Say Die" editorials for years, and have also been reading the "Letters" section of *73*, which are far more interesting than the same section in competing magazines, for two reasons: One, the letters appear to be printed in full; and two, they often contain replies.

Actually I've been a Green fan ever since you were my first New Hampshire contact on 2 meter AM back in 1966 when I was a new Novice in New Jersey running a Heath "Twoer." To make a contact with NH using about 1.5W output to a little 8-element yagi—a 250-mile path over hilly terrain using terrible equipment on my end—was such a staggering accomplishment that it turned me on to VHF/UHF for life. I believe on your end, you were running high power and an enormous collinear antenna part way up Mt. Monadnock. You used to generate pileups among us "lowland leaf-lookers" in NJ and PA.

In the December *73* "Random Output" by David Cassidy, Dave recalls the magic of wireless communications and how the newcomers to the hobby might miss out on the feeling. I agree. It's sad that most new hams are such appliance operators; they never think about what goes on inside their equipment to make easy QSOs possible. Anybody who hasn't home-brewed at least one complete setup, or at least a simple transmitter, doesn't know what he's missing.

Over the past 25 years, I've upgraded to Extra (I love CW, anyway; color me crazy) and home-brewed dozens of stations, sometimes including complete receivers (what a job!) and often of my own design, good or bad. All my kW amplifiers are home-brewed, except for one Henry Radio RF deck using a 3CX1200D7, and I built the power supply for that. Now, living in a townhouse in Los Angeles, after owning several homes on large lots back East, I enjoy the challenge of working DX using small antennas, or going hill-topping to work VHF DX. There are always a million challenges! To sit in front of one's store-bought transceiver for hours on end cannot be anybody's idea of a thrill . . . can it?

I agree with you, we need more young blood in amateur radio. It does seem that most of my CW contacts are with retired folks who learned the code before or during WWII. Even the world-class contesters, presumably the best operators in the world, are getting older. Who will replace them, to set new standards? Who is going to be the first to make 300 QSOs/hour in a contest? Work DXCC in 60 minutes? Develop systems to make packet meteor scatter contacts a daily occurrence? Keep pushing for less restrictive legislation regarding antenna and tower zoning and ordinances? Design the new amateur equipment? Distribute and sell it?

There's far fewer ham stores in America than ever in my personal tenure. I don't see how any of them make it. I'm lucky enough to be within a one-hour's drive on crowded freeways to not just one or two, but *five* amateur radio outlets. This may exist only in Los Angeles. Used to be, New York City alone had a dozen—but I believe only Barry remains. And do the "locals" support their local dealers? Not by a long shot! Most folks around here would rather mail-order their gear to save the sales tax. Big deal! They probably save $35 on a $1,000 purchase when the shipping costs are added in.

Then, the average ham is looked upon as a weirdo by the rest of society, anyway. Many are socially inept, severely introverted (except on the air). Some are bona fide sociopaths! (Just listen in on a couple of the wide-coverage L.A.-area repeaters.)

What can we do to generate interest among the youngsters, who might be able to save ham radio? For starters, we can get our own kids interested and licensed. Every licensed amateur who is a school teacher at any level should introduce the wonders of wireless communication to his or her students—maybe even convince the board to make ham radio an accredited class. Every active ham who is a radio club member should bring one non-ham to the next club meeting, and make the effort to introduce that person to the gang. Make an issue of it, with formal introductions and the rolling out of a great, big welcome mat. We have a great hobby for retirees, but licensing the old-timers will not help the service survive. Only the kids can do that.

Every time I have a youngster in my car, for any reason, I don't ignore the two transceivers installed therein. I pick up the mike and make a few contacts, explaining to the visitor what's going on and how much fun it is. Their eyes open wide as they hear the foreign accents rolling in on my 10 meter rig, and get wider when they hear an Aussie or Slav respond to my call. "How's the weather there in Belgrade, old man? Do you do any skiing on all that snow?" "Do you guys in Sydney really use boomerangs to get your dipoles up in the trees?" Make it interesting! The kids are guaranteed to go nuts, asking questions about how to get licensed.

I show my limited DX QSL card collection (about 100 countries are hanging on the wall—the most interesting cards I could pick out from my collections, with bright colors and bold descriptions of the DX locations) to practically every single visitor to our home. Since everybody here in California is from someplace else (or so it seems!), I ask each new acquaintance where they're from, and try to show them one QSL card from that place, stating proudly, "Oh, yeah, I know this guy Sam from there. He's an avid fisherman, and pulls the big trout out of Lake Whatchamacallit." They are absolutely dumbfounded. Maybe one in five will ask some questions about ham radio . . . then they're hooked.

My eight-year-old nephew, better traveled than most because he was born in the Middle East, lives with us. He's probably the only third-grader in his school who actually knows where all the DXCC countries are, along with the names of countries no longer in existence, and what's taken their places. With mildly incapacitating cerebral palsy, his coordination is not great, but he can copy 5 wpm and get most of it down on paper. A Novice ticket can't be more than a year away—probably closer—for him. He's the only eight-year-old I know who can answer nearly all the "World Geography" questions on Jeopardy! He's also getting a grasp of simple algebra, which won't be taught in his school for another two years, based on his interest in Ohm's Law.

There are as many ways to get youngsters interested in radio as there are youngsters. One only needs to take a bit of time to find the right button to push. I compel anyone interested in the future of amateur radio to look for those buttons, push them, and keep on pushing until all the neighborhood kids have their tickets.

I know you're not just trying to sell more magazines, Wayne. There are lots of easier ways to make money. If the hobby were healthier, really booming, *73* could be free, paid for entirely by advertising revenues. Keep up the battle. Some really are listening. And thanks for being my first 2 meter DX contact, 25 years ago. I still remember.

Thanks for taking the time to write such a great letter. I wish more hams would do that! I'll be publishing it . . . hoping that maybe you can get some of these tired old geezers off their butts.

Good news: I'm getting closer to getting NH to set up my electronics education course. This could turn out 10,000 hams a year. Just from NH! . . . Wayne

Trevor M. Artingstoll G6JOE, UK So Ole Ozzie KA1BIK is the other guy left on the planet with radio dust infection? I suggest we manufacture the drug and peddle it in schools and institutions of higher learning. I'd pay $100 for an inhaler packet with the stuff, myself. Imagine, in a duli moment, unscrewing the little plastic cap, inserting the tube delicately into the waiting nostril, and—kepow!—back to the Land of Glowing Bottles—searching in the coal box for gold streaks to stick in a crystal set—wrecking basket coils for the hell of it—soldering real, honest-to-God, *solid* copper wire seductively wrapped in cotton—drilling ebony wood front panels—! But I speak a foreign language to young and middle-aged hams. Sigh! There's no cure, you know.

David Terrell KB5LAM/AA Thanks for producing a high-quality product. I weighed *73, CQ, QST,* and *World Radio* in the balance. *73* has the best mix of the things I want to see. I devour the technical issues and construction articles. I also enjoy the human side about clubs and individuals. I've requested the writing quidelines you've established and intend on trying my hand in both areas.

Lowell E. Robertson K6QXQ, Riverside CA I am rather slow at responding to the article, "Rad Radiator," in the May 1990 issue of *73*. I just want to comment that the wire hanging down from the bottom of the walkie-talkie creates a variation of the "counterpoise" antenna which may be a long forgotten antenna type. This may sound critical of an otherwise well-written article, but the term "counterpoise" has a more professional ring than "rad radiator."

Richard Ernst /EA7, FPO NY Three months ago I purchased the new *1990 ARRL Handbook* at the cover price of $23. Table 42 on pages 35–38, and 39 contains the "ARRL Parts Supply List." Being an avid home-brewer of just about everything, and being posted overseas, I said to myself, "Rich, here is your source of mail-order parts." I sent 12 letters to companies on this ARRL list, and as of today I have yet to receive the first reply. After 26 years I guess I haven't learned my lesson yet. Caveat ??

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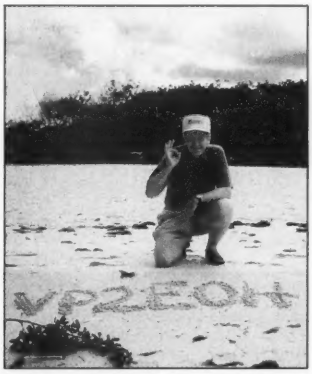

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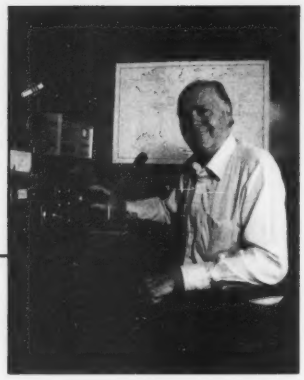

NEVER SAY DIE

Wayne Green W2NSD/1

Scrambled Brains

Some years ago in one of my usual feeble attempts at humor I suggested that since we seemed to have far more bad operating problems with our Extra Class hams than with others, maybe the Morse code had scrambled their brains. One advertiser, with a sense of humor down in the molecular range, canceled all his ads in *73* in retaliation. Well, that means you readers have been out about five good construction projects a year that these ads would have made it possible for us to publish, and the advertiser has thrown away around $200,000 a year in sales. I have to admire such strong convictions, no matter how misplaced.

I know you're hoping I'll digress with more irrelevancies, but no, I'm going to get back to the subject at head. Okay, for those few readers who are borderline illiterate . . . in other words, who do not subscribe to *The New Yorker* magazine . . . I've some news. Paul Brodeur, the chap who wrote a three-part series in the same magazine last year about the effects of weak electromagnetic (EM) forces on cells, has been at it again. Look for his book, *Currents Of Death*.

ARRL stalwarts who bothered to attend the 1989 League convention had the opportunity to hear Dr. Ross Adey K6UI give a remarkable talk on the subject. I recently watched a video tape of his address . . . something every ham club should put on their program. My tape came from WA6PMX. Ross is one of the leading scientists working in this field . . . another feather in the cap of amateur radio.

The latest Brodeur *New Yorker* article picks up from where he left off the year before. It turns out that not only do incredibly weak EM forces have very measurable effects on cell growth and communications, this is exacerbated when there are switching transients involved. Square waves.

The human statistics back up scientific experiments with mice and chicks. Women who use electric blankets are having a greatly increased incidence of miscarriages and malformed children. There's a strong link to cancer, too. My first solution to this was to suggest rectifying the current and making it DC. Nope, as long as you have those infernal thermostats turning the DC on and off all night, you're hitting your whole body with square waves. Bad news.

Brodeur reported on the incredible incidence of brain tumors across the street from a power substation in Connecticut . . . and the high incidence of tumors among power company workers. We see a similar higher than normal incidence of cancers with hams. Ross pointed out in his talk how the League flatly refused to cooperate with research aiming at getting this information.

This opens up some very serious questions for us. First, there is a need for you to make sure that you elect a new director, one who will force the League to cooperate with researchers in studying such matters. I can understand why the League has a vested interest in trying to cover this up. This is the same route taken by the tobacco industry when it was suggested that cigarettes might be harmful. That industry **still** isn't convinced.

But let's suppose that the obvious is actually true . . . that the powerful square wave EM field our transmitter generates when we send Morse code does affect the cells of our bodies and brains to some degree. Our systems do a heroic job of repairing damage done by carcinogenic materials we eat and breathe. But can we really expect this repair system to be able to cope 100% with powerful and extended daily blasts of EM energy which screw up cell growth and communications in our brains and every part of our bodies? I'll be surprised if we don't find that dedicated CW operators . . . particularly those running some power . . . aren't dying far faster than our actuarial tables predict. Our beloved, worshipped Morse code could well be killing us.

Even More Bad News

Okay, we can see where we might be in trouble when we're transmitting, but at least we can receive code without worrying, right? Oh yeah? When you're receiving Morse at 20 per, that's at about 6.4 Hz. You're blasting your brain with a 6.4 Hz set of square waves. We've isolated several of the operating frequencies of the brain and they're all in the low Hz range.

Is it really just a coincidence that such a heavy proportion of the troubles we've been having in amateur radio seem to be with Extra Class operators? Is it entirely a coincidence that almost none of the Bash-licensed Extras are in trouble? We know that a high percentage of the Bashers never had to bother learning the code.

The personality changes which the code may be making in us would occur slowly, over a period of years, so families and friends would come to accept them, no matter how bizarre they are. Wives somehow manage to get used to DXers putting a new country before the marriage, children or even making a living.

Ham dealers joke about hams being crazy. Do we become hams because we're crazy or vice versa? No, I agree, not all hams are crazy. I don't think I am, but you know I'm not going to ask for a second opinion. Is it mainly Extras and their 20 wpm code? How much of an effect can 13 per have? Maybe we can accept amateur radio only partially addling our brains.

I know this, I'm keeping my linear amplifier far enough away from my operating position so I'm not going to be milligaussed and square-waved. I'm going to steer well clear of Morse, both receiving and transmitting. I suspect that frequency-shift keying may be far more benign.

You may be sure that I'm going to keep HTs with subaudible tone generators far away from my body. Ross has published some frightful charts in scientific journals showing what a 450 MHz HT with a 16 Hz tone can do to cells.

An Opportunity

As the media begins to understand the extent of the damage being done to people by electromagnetic radiation, I'll be surprised if they don't jump on this gloom and doom bandwagon and scare the public silly. This should open an opportunity for entrepreneurs to offer degaussing services.

You can build or buy a milligaussmeter pretty reasonably. As the demand goes into panic mode, we'll go through the usual shortage/glut roller coaster ride. With a meter and some understanding of EM, entrepreneurs should be able to set up some very profitable businesses.

If you think old Uncle Wayne is pulling your leg, check out *Time*, July 30th, page 53. I do my homework before I write, even when it means wading through a pile of heavy duty research journal reports. I'll put the bibliography on the *73* BBS, if you'd like to check it out.

From what I've read so far it seems very likely that further research could show that CW ops running a couple hundred watts are getting a carcinogenic blast of EM which is equivalent to smoking a pack or two of cigarettes a day. This stuff is insidious, like cigarettes. It won't kill you in a day or a week, but slowly, over a period of years, it may be changing your personality (not likely for the better) and shortening your life. I feel tremendously lucky that I changed to frequency-shift keying 40 years ago.

The Bottom Line

So it looks as if Sam Morse didn't do us any favors. The code not only has little place in modern radio communications, it may well be damaging our minds and bodies and sending us to an early grave.

As Ross pointed out, anyone who says this is controversial is ignoring incontrovertible facts. But I can understand an urge to dismiss bad news. There must be some mistake. Our government wouldn't let us use electric blankets if they were dangerous, right? Sure, like they don't let us drink alcohol and they don't let us smoke. When the dollars involved are big enough, Congress will go along with the money, no matter how many people get killed.

Our Cells

If you do some homework you'll find that our cells work on a combination of electrical and chemical reactions. They are busy working and duplicating themselves, all as part of a cooperating group. They communicate electrically, using low Hz frequencies. The duplication process involves the magnetic transfer of information as DNA molecules copy and split. Part of this is chemical, part electrical, and part is magnetic.

We can interfere with this process with drugs and interfering magnetic fields, but the body only has so much ability for self-repair and when eventually we exceed that the cells go berserk. Cancer. Tumors. Miscarriages. Deformed children. Children with damaged genes which may not kick in until years later. We'll know more about those effects as the Genome Project progresses.

If you think Wayne is full of baloney on this one, do me a favor. Go back through my 40 years of editorials and show me where I have ever been wrong on a scientific matter.

Flaplet

If you don't read the ARRL HQ BBS you missed a great item telling how angry a couple of ARRL officials were at the recent Houston Ham Com. They were mad because their ARRL booth for selling *QST* subscriptions and League books wasn't allowed free into the paid vendor area. They were further steamed when they were refused

Continued on page 73

KENWOOD

...pacesetter in Amateur Radio

All-mode tri-bander!

TS-790A

Satellite Transceiver

The new Kenwood TS-790A VHF/UHF all-mode tri-band transceiver is designed for the VHF/UHF and satellite "power user." The new TS-790A is an all-mode 144/450/1200 MHz transceiver with many special enhancements such as automatic uplink/downlink tracking. Other features include dual receive, automatic mode selection, automatic repeater offset selection for FM repeater use, VFO or quick step channel tuning, direct keyboard frequency entry, 59 memory channels (10 channels for separate receive and transmit frequency storage), multiple scanning and multiple scan stop modes. The Automatic Lock Tuning (ALT) on 1200 MHz eliminates frequency drift. Power output is 45 watts on 144 MHz, 40 watts on 450 MHz, and 10 watts on 1200 MHz. (The 1200 MHz section is an optional module.)

- **High stability VFO.** The dual digital VFOs feature rock-stable TCXO (temperature compensated crystal oscillator) circuitry, with frequency stability of ±3 ppm.
- **Operates on 13.8 VDC.** Perfect for mountain-top DXpeditions!
- **The mode switches confirm USB, LSB, CW, or FM selection with Morse Code.**
- **Dual Watch allows reception of two bands at the same time.**
- **Automatic mode and automatic repeater offset selection.**
- **Direct keyboard frequency entry.**
- **59 multi-function memory channels.** Store frequency, mode, tone information, offset, and quick step function. Ten memory channels for "odd split."
- **CTCSS encoder built-in.** Optional TSU-5 enables sub-tone decode.
- **Memory scroll function.** This feature allows you to check memory contents without changing the VFO frequency.
- **Multiple scanning functions.** Memory channel lock-out is also provided.
- **ALT—Automatic Lock Tuning—on 1200 MHz eliminates drift!**
- **500 Hz CW filter built-in.**
- **Packet radio connector.**
- **Interference reduction controls:** 10 dB RF attenuator on 2m, noise blanker, IF shift, selectable AGC, all mode squelch.
- **Other useful controls:** RF power output control, speech processor, dual muting, frequency lock switch, RIT.
- **Voice synthesizer option.**
- **Computer control option.**

Optional Accessories:
• **PS-31** Power supply • **SP-31** External speaker • **UT-10** 1200 MHz module • **VS-2** Voice synthesizer unit • **TSU-5** Programmable CTCSS decoder • **IF-232C** Computer interface • **MC-60A/MC-80/MC-85** Desk mics • **HS-5/HS-6** Headphones • **MC-43S** Hand mic • **PG-2S** Extra DC cable

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications, features, and prices are subject to change without notice or obligation.

KENWOOD

KENWOOD U.S.A. CORPORATION
COMMUNICATIONS & TEST EQUIPMENT GROUP
P.O. BOX 22745, 2201 E. Dominguez Street
Long Beach, CA 90801-5745

KENWOOD ELECTRONICS CANADA INC.
P.O. BOX 1075, 959 Gana Court
Mississauga, Ontario, Canada L4T 4C2

KENWOOD

Compact Champion!

TH-27A/47A

2 m and 70 cm Super Compact HTs

Here is a great new addition to Kenwood's HT family — the all new TH-27A for 2 meters and TH-47A for 70 cm! Super compact and beautifully designed, these pocket-sized twins give you full-size performance.

- **Large capacity NiCd battery pack supplied.** The standard battery pack is 7.2 volts, 700 mAh, providing extended transmit time with 2.5 watts. (TH-47A: 1.5 W.)
- **Extended receive coverage.** TH-27A: 118—165 MHz; TH-47A: 438-449,995 MHz. TX on Amateur bands only, (TH-27A modifiable for MARS/CAP. Permits required. Specifications guaranteed for Amateur bands only.)
- **Multi-function scanning.** Band and memory channels can be scanned, with time operated or carrier operated scan stop.
- **Frequency step selectable for quick QSY.** Choose from 5, 10, 12.5, 15, 20, or 25 kHz steps.
- **Built-in digital clock** with programmable timer.
- **Dual Tone Squelch System (DTSS).** Compatible with the TH-26AT Series and the TM-941A Triple bander, as well as other Kenwood series transceivers, this selective calling system uses standard DTMF to open squelch.
- **Five watts output** when operated with PB-14 battery pack or 13.8 volts.
- **T-Alert for quiet monitoring.** Tone Alert beeps when squelch is opened.
- **Auto battery saver, auto power off function, and economy power mode extends battery life.**
- **DTMF memory.** The DTMF memory function can be used as an auto-dialer. All characters from the 16-key pad can be stored, allowing repeater control codes to be stored!
- **41 memories.** All channels store receive and transmit separately for "odd split."
- **DC direct in operation.** Allows external DC to be used (7.2 – 16 volts). When external power is used, the batteries are being charged. (PB-13 only.)

Optional accessories:
• **BC-14:** Wall charger for PB-13 • **BC-15:** Rapid charger for PB-13, 14 • **BC-16:** Wall charger for PB-14 • **BH-6:** Swivel mount • **BT-8:** Six cell AA Alkaline battery case • **HMC-2:** Headset with VOX and PTT • **PB-13:** 7.2 V, 700 mAh NiCd pack • **PB-14:** 12 V, 300 mAh NiCd pack • **PG-3F:** DC cable with filter and cigarette lighter plug • **PG-2W:** DC cable • **SC-31:** Soft case • **SMC-31:** Standard speaker mic • **SMC-32:** Compact speaker mic • **SMC-33:** Compact speaker mic with controls • **WR-2:** Water resistant bag.

- **Automatic offset selection (TH-27A).**
- **Direct keyboard frequency entry.** The rotary dial can also be used to select memory, frequency, frequency step, CTCSS, and scan direction.
- **CTCSS encode/decode built-in.**
- **Supplied accessories:** Rubber flex antenna, battery pack, wall charger, belt hook, wrist strap, dust caps.

Specifications and features are subject to change without notice or obligation.
Complete service manuals are available for all Kenwood transceivers and most accessories.

KENWOOD U.S.A. CORPORATION
COMMUNICATIONS & TEST EQUIPMENT GROUP
P.O. BOX 22745, 2201 E. Dominguez Street
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KENWOOD ELECTRONICS CANADA INC.
P.O. BOX 1075, 959 Gana Court
Mississauga, Ontario, Canada L4T 4C2

KENWOOD

...pacesetter in Amateur Radio

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

No Code At Last!

On December 13, 1990 the first no-code amateur radio operator's license in the U.S. was approved by FCC Bureau Chief Haller and Commissioners Cross, Quello, Duggen, and Sykes. Docket 90-55 establishes a codeless license by eliminating the code requirement for the Technician class license. This is the first no-code license in the history of the U.S. Amateur Radio Service.

Applicants for the new Technician license will have to take the theory exams, a total of 55 questions, required for both the Novice and Technician class licenses. The new Technician will be granted all privileges on all frequency bands currently allowed to Technician class license holders, but only for operation above 30 MHz (6 meters and above).

For existing Technician class license holders, nothing changes. Technicians licensed before the implementation of the new codeless license will be grandfathered to protect their earned HF operating privileges, including 10 meter radiotelephone. The Novice class is also unaffected by this change.

The new Technician will be able to experiment with exotic modes, own repeaters and remote base stations, but not participate in HF operation unless HF privileges are gained by passing the 5 wpm Morse code test through the VEC system.

Originally, the FCC had proposed the phasing out of both the Novice and Technician classes, claiming widespread cheating in Novice testing and a general need to save money. The ARRL said the abolition of both classes was unacceptable, and several VECs offered to bring Novice testing, at no cost, under the VEC system. At FCC conventions, the media demanded proof of the cheating claim, which the FCC failed to provide. Also, individuals and groups presented the FCC with information that refuted their budget-saving argument.

In the end, the FCC opted to follow the suggestions of the Quarter Century Wireless Association (QCWA). They retained both license classes and modified the requirements for a Technician class license to create a code-free entry into amateur radio. Many of us hope that this will increase the growth of amateur radio without decreasing the quality. Says Bureau Chief Haller, "Morse code does not prove what kind of operator you are going to be. It only proves that you can send and receive Morse code! We [the FCC] are retaining a written test. There is a license that can be lost for . . . violation of the rules . . . ."

All five FCC commissioners agreed that passing Docket 90-55 will keep the nation at the forefront of communications research and development, and help recruit technically inclined people into the Amateur Radio Service.

There will not be any call-letter distinctions between the old and the new Technicians. It will still be up to the amateur community to police its own ranks.

Most experts feel that full implementation could take place as early as February 1, 1991. *TNX Bill Pasternak WA6ITF of Westradio and Amateur Radio Newsline, and Paul Courson WA3VJB, Washington correspondent.*

Docket 90-356

The above FCC commissioners also passed Docket 90-356, the CW waiver for certain handicapped individuals. Passage of this docket exempts handicapped persons from the high-speed code exams if their physical condition makes it impossible for them to learn code at the required speeds. Commissioner William Cross says that the FCC "will rely on a physician's certification of disability to determine eligibility of an applicant."

Private Radio Bureau Chief Ralph Haller W4RH said that relaxing code requirements for the handicapped, along with establishing the new codeless Technician license, will promote further growth of amateur radio. During the presentation, Chief Haller held up a 2 meter HT and declared it a symbol of the vital role amateur radio plays. He said that because of amateur radio operators volunteering their time and personal funds, ". . . it is possible to communicate essentially around the world with a small radio like this! It gives you an idea of the dedication of these amateurs to the advancement of the radio art."

Commissioner Quello stated his personal feeling that it was definitely time to open the gates of amateur radio to those who may not be able to master the Morse code. He noted that today, "Most [communication] is by voice, anyway."

Commissioner Irvil Duggen said, "There was some fear in my mind [at first], that we might be leaning over too far backwards in relaxing our standards, and that in trying [to be] compassionate and responsive to the special needs of handicapped people, we would in fact rob them of the pride that they might otherwise have in being able to meet tough standards . . ." But the hundreds of comments the FCC received from people and groups "removed that concern."

Chairman Sykes said that "The steps we took to broaden [the Amateur Radio Service] . . . holds the potential to provide an even more vital and dynamic service."

All five commissioners voted unanimously on both agenda items: Approving CW waivers for handicapped hams who want to upgrade, and dropping the CW requirement for the Technician class license. *TNX Bill Pasternak WA6ITF of Westradio and Amateur Radio Newsline, and Paul Courson WA3VJB, Washington correspondent.*

The ARRL's Response

Subject: ARRL No-Code Reconsideration. The ARRL applauds retention of the Novice license and seeks input on privileges for codeless technicians.

Responding to the Federal Communications Commission action PR Docket 90-55, creating a codeless class of amateur radio license, the president of the American Radio Relay League, Larry Price W4RA, noted with pleasure that the Commission had decided to retain the Novice license as a means of entry into amateur radio and to adopt a codeless license with a meaningful written examination requirement. "Our members were very strong on both of these points, because they couldn't imagine how we could maintain the character of the Amateur Radio Service without them," Mr. Price said.

However, President Price sounded a note of caution with regard to the privileges the Commission plans to grant to the codeless licensees. "The formula developed by the ARRL Board of Directors, which called for privileges above 220 MHz, was based on extensive membership input. It was carefully balanced to offer attractive privileges while protecting existing patterns of amateur activity."

While it will take some time to gauge the reaction to the Commission action, Dr. Price observed that the FCC formula is likely to be less acceptable to many amateurs than the League's. He asked that League members share their views with their elected directors, who collectively determine League policy.

"Before we can decide whether to request that the Commission partially reconsider its action, we'll have to see the Report and Order," said Mr. Price. Usually it takes the FCC from several days to several weeks after a Commission action to release an item after editorial review. There is a 30-day window of opportunity following release in which petitions for reconsideration can be filed. Mr. Price noted that the ARRL Board is holding its regular meeting January 18–19. "The timing looks good for a careful review of the Commission's action at that meeting," he said.

For further Information contact: David Sumner K1ZZ, tel: 203-666-1541; Fax: 203-665-7531. *TNX Bill Pasternak for sending us this Amateur Radio News Release from the American Radio Relay League,Inc., via MCImail on Dec. 19, 1990.*

QRX . . .

Persian Gulf Bands

Nearly 400,000 U.S. troops in the Persian Gulf means increased military communications on the HF bands. Here are some USAF Global Command and Control System (GCCS) frequencies in kHz, USB:

•Loring AFB, ME: 3074, 6738, 8964, 11179, 13214.

•MacDill AFB, FL: 4746, 6750, 8993, 11246, 11288, 13244, 18019.

•Ascension Island: 6750, 8993, 11176, 13244, 15015.

•Croydon, UK: 3067, 5703, 6750, 9011, 11176, 13214.

•Incirlik, Turkey: 3137, 6738, 11176, 13214, 15015, 23227.

The Saudi Air Force can be heard on 3095, 5526, 8967, and 8990. Dharan Air Base has been heard on 9130 and 11100, using the callsign "Hotel 1"; Riyadh "Hotel 2" is on 7300 and 12112. The U.S. Army Corps of Engineers in Saudi Arabia are on 9130 and 11425, using callsigns "Castle 1" through "Castle 8". 11300 is another active frequency in the area. The United Nations forces are assigned the following sets of frequencies:

•Primary: 6632, 9006, 11233, 13231, 13257.

•Secondary: 4704, 5690, 6204, 6810, 6905.

Middle East air traffic controllers for the Gulf Region operate on: 2992, 3404, 5603, 5658, 5667, 8847, 8918, 10018, 13288, 13312, 13336. In the gulf and nearby waters, the U.S. Navy has been heard challenging commercial vessels. The most active channels have been 4125, 1413, 4419, 6218, 6519, 6521, 8291, 8294, 12492, 12435, 16587, 16590, 16593, 22105, 22124, 22127, 22130, and 22136. Also check out their HICOMM channels on 7525, 12215, and 23315.

And remember, don't CQ Kuwait. A QSO with a Kuwaiti amateur could cost him his life. *TNX* Nashua Area Radio Club Bulletin, *and Ed Brown KB1MZ in particular.*

SAREX Success!

Over 500 hams were able to communicate with Ron Parise WA4SIR during the recent STS-35 space shuttle mission. The robot packet experiment was a success with 238 stations worldwide completing two-way packet contacts. Several hundred more were at least heard by the shuttle. Quite a few voice contacts were made, primarily in Australia, South America, and South Africa. A number of scheduled voice contacts were made as well during the evening passes over the U.S. Twenty-eight school groups in the U.S. had a chance to talk with Ron, via a telephone bridge to the uplink sites, while he was over Australia and Brazil.

A QSL will be issued to those who send in any received packets from the shuttle (QRZ logs). Please include the date/time of the reception. This information will help determine all of the stations who made one-way connects up to the shuttle. Please send your receive buffer files to the ARRL, Attention: Rosalie White, 225 Main St., Newington CT 06111. It would help to send an additional copy directly on packet to SAREX @ W3IWI.MD.USA.NA (or via internet mail to: sarex@tomcat.gsfc.nasa.gov).

A complete wrap-up of the STS-35 mission along with news of the upcoming STS-37 mission will appear in the March issue of *73. TNX AMSAT and WB8ELK.*

Get Rich—

—beyond your wildest dreams! Or, at least make a few bucks for yourself or your club.

The staff of *73* tries to get to as many hamfests as we can, but there are plenty we miss. That's where you come in. We'll pay you (or your club) to run a *73* booth for us. It's easy. We'll send you everything you need. You staff the booth and take subscription orders, and we'll give you a cut for every order you take. That's cold, hard cash! Up front. At an average hamfest, you should make a couple of hundred. Not bad for a few hours' work—plus, you'll get the personal satisfaction of sharing *73* with your local ham friends. OK, forget about personal satisfaction—do it for the dough! Just call Donna DiRusso at (603) 525–4201. *From the staff.*

TNX . . .

. . . to all our contributors. You can reach us by phone at (603) 525–4201, or by mail at *73 Magazine,* Forest Rd., Hancock NH 03449; and by e-mail on CompuServe ppn 70310,775, MCI Mail "WGEPUB" and the *73* BBS at (603) 525–4438 (300–2400 bps), 8 data bits, no parity, one stop bit.

Boy Scouts from Troop 73, Springfield, and Troop 94, Hillside, New Jersey, participated in the 33rd annual Jamboree On the Air, or JOTA, last October, when thousands of hams opened their stations to scouts. Above, at the Watchung Reservation in Mountainside, New Jersey, Springfield Emergency Management Staff KB2KOQ, KB2KEC, WA2WUX, WA2QNZ, KB2KEC, and WA2BAT (not in photo) set up a temporary outdoor radio station using a Kenwood TS-430S and long-wire Windom antenna.

MFJ TUNERS

Here is the finest 3 KW Tuner money can buy with roller inductor, dummy load, *new* peak reading meter, antenna switch, balun plus more ... $349.95

The MFJ-989C is not for everyone.

However, if you do make the investment you get the finest 3 KW PEP tuner money can buy - one that will give you a lifetime of use, one that takes the fear out of high power operation and one that lets you get your SWR down to absolute minimum.

The MFJ-989C is a compact 3 KW PEP roller inductor tuner with a new **peak** reading Cross-Needle SWR/Wattmeter. The roller inductor lets you get your SWR down to absolute minimum.

With **three continuously** variable components - two massive 6 KV capacitors and a high inductance roller inductor - you get precise control over SWR **and** the widest matching range possible from 1.8-30 MHz.

MFJ-989C **$349.95**

You get a **new** lighted **peak** and average reading Cross-Needle SWR/Wattmeter with a **new** more accurate directional coupler.

You get a giant two core balun wound with teflon wire for balanced lines and a 6-position antenna switch with extra heavy switch contacts.

Its compact 10¾x4½x15 inch cabinet fits right into your station.

You get a 50 ohm 300 watt dummy load for tuning your exciter, a tilt stand for easy viewing and a 3-digit turns counter plus a spinner knob for exact inductance control. Add $10 s/h.

2-knob *Differential-T*™ Tuner

MFJ-986 **$289.95** The **new** MFJ-986 Differential-T™ 2-knob Tuner uses a differential capacitor to make tuning foolproof and easier than ever. It ends constant re-tuning with broadband coverage and gives you minimum SWR at only **one** best setting. Covers 1.8-30 MHz.

The roller inductor lets you tune your SWR down to absolute minimum. 3-digits turns counter lets you quickly return to your favorite frequency.

You get MFJ's **new** peak and average reading Cross-Needle SWR/Wattmeter with a **new** directional coupler for more accurate readings over a wider frequency range. It reads forward/reflected power in 200/50 and 2000/500 watt ranges. Meter lamp uses 12 VDC or 110 VAC with MFJ-1312, $12.95.

A **new** current balun for balanced lines reduces feedline radiation and forces equal currents into antenna halves that are not perfectly balanced for a more concentrated, stronger signal. Add $10 s/h.

MFJ's *Fastest Selling* Tuner

MFJ-941D **$109.95** **The MFJ-941D is MFJ's fastest selling 300 watt PEP antenna tuner. Why? Because it has more features than tuners costing much more and it matches everything continuously from 1.8-30 MHz.**

It matches dipoles, vees, verticals, mobile whips, random wires, banlanced and coax lines.

SWR/Wattmeter reads foward/reflected power in 30 and 300 watt ranges. Antenna switch selects 2 coax lines, direct or through tuner, random wire, balanced line or tuner bypass. Efficient airwound inductor gives lower losses and more watts out. Has 4:1 balun. 1000 V capacitors. 10x3x7 inches.

MFJ's *Random Wire* Tuner

MFJ-16010 **$39.95**

You can operate all bands anywhere with any transceiver when you let the MFJ-16010 turn any random wire into a transmitting antenna. Great for apartment, motel, camping operation. Install a wire anywhere! Tunes 1.8-30 MHz. 200 watts PEP. Ultra small 2x3x4 in.

MFJ's *Deluxe* 300 Watt Tuner

MFJ-949D **$149.95** **The** MFJ-949D gives you lower SWR than **any** tuner that uses two tapped inductors. Why? Because you get two **continuously** variable capacitors that give you infinitely more positions than the **limited** number on switched coils.

This gives you the precise control you need to get your SWR down to a minimum. After all, isn't that why you need a tuner? Covers 1.8-30 MHz.

You get MFJ's **new** lighted 2-color **peak** and average reading Cross-Needle SWR/Wattmeter, dummy load, antenna switch, and 4:1 balun - all in a compact 10x3x7 inch cabinet. Meter lamp uses 12 VDC or 110 VAC with MFJ-1312, $12.95.

With MFJ's **deluxe** 300 watt PEP tuner you get an MFJ tuner that has earned a reputation for being able to match just about anything - one that is highly perfected and has years of **proven** reliability.

MFJ's *Mobile* Tuner

MFJ-945C **$89.95**

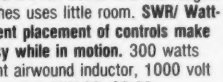
Don't leave home without this **mobile** tuner! Have an uninterrupted trip as the MFJ-945C **extends your antenna bandwidth** and eliminates the need to stop, go out and adjust your mobile whip.

You can **operate anywhere in a band and get low SWR.** You'll get maximum power out of your solid state or tube rig and it'll run cooler and last longer.

Small 8x2x6 inches uses little room. **SWR/ Wattmeter and convenient placement of controls make tuning fast and easy while in motion.** 300 watts PEP output, efficient airwound inductor, 1000 volt capacitors. Mobile mount, MFJ-20, $3.00.

144/220 MHz VHF Tuners

MFJ-921 **$69.95**



MFJ's new VHF tuners cover both 2 Meters and the 220 MHz bands. They handle 300 watts PEP and match a wide range of impedances for coax fed antennas. SWR/Wattmeter. 8x2½x3 in. **MFJ-920, $49.95.** No meter. 4½x2½x3 inches.

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762
(601) 323-5869; TELEX: 53 4590 MFJSTKV

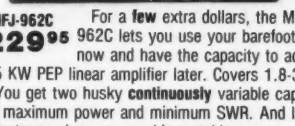
MFJ ... making quality affordable

MFJ's *Artificial* RF Ground

$79.95 MFJ-931

You can create an artificial RF ground and eliminate RF "bites", feedback, TVI and RFI when you let the MFJ-931 resonate a random length of wire and turn it into a tuned counterpoise. The MFJ-931 also lets you electrically **place a far away RF ground directly at your rig** -- no matter how far away it is -- by tuning out the reactance of your ground connection wire.

Barefoot/1.5 KW Linear Tuner



MFJ-962C **$229.95** For a **few** extra dollars, the MFJ-962C lets you use your barefoot rig now and have the capacity to add a 1.5 KW PEP linear amplifier later. Covers 1.8-30 MHz.

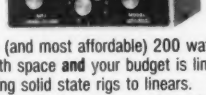
You get two husky **continuously** variable capacitors for maximum power and minimum SWR. And lots of inductance gives you a wide matching range.

You get MFJ's **new** peak and average reading Cross-Needle SWR/Wattmeter with a **new** directional coupler for more accurate readings over a wider frequency range. It reads forward/reflected power in 200/50 and 2000/500 watt ranges. Meter lamp uses 12 VDC or 110 VAC with MFJ-1312, $12.95.

Has 6-position antenna switch and a teflon wound balun with ceramic feedthru insulators for balanced lines. 10¾x4½x14 7/8 inches. Add $10.00 s/h.

MFJ's *smallest* Versa Tuner

MFJ-901B **$59.95**



The MFJ-901B is our smallest -- 5x2x6 inches -- (and most affordable) 200 watt PEP tuner --when both space **and** your budget is limited. Good for matching solid state rigs to linears.

It matches whips, dipoles, vees, random wires, verticals, beams, balanced and coax lines from 1.8-30 MHz. Efficient airwound inductor. 4:1 balun.

FOR YOUR NEAREST DEALER OR TO ORDER

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• 1 year **unconditional** guarantee • 30 day **money back** guarantee (less s/h) on orders from MFJ • Free catalog • Add $5.00 s/h (except as noted)

CIRCLE 86 ON READER SERVICE CARD

Radar Detector to Microwave Receiver Conversion

Listen on 10 GHz, cheap.

by Steve J. Noll WA6EJO

The abundance of so-called "police radar detectors" made me wonder if these devices might have a useful application for the amateur microwave experimenter. These self-contained receivers are designed to detect police speed-measuring radar energy around 10.525 GHz (also 24.125 GHz in K-band), just above the 10.0 GHz–10.5 GHz Amateur Radio Service allocation.

Although there are plenty of these devices on the market, many of them are expensive for experimenting with. However, C.O.M.B. Company had been selling the BEL XKR series detector for very reasonable prices. I just couldn't resist! (The C.O.M.B. Company is located at 1405 Xenium Lane N., PO Box 32, Minneapolis MN 55440-9176. Tel. 800–328–0609 or contact BEL-Tronics, 20 Center Dr., Orchard Park NY 14127. Tel. 716-662-0522.)

I opted for the BEL XKR-IX Micro-Eye model although any of the XKR series should be similar. The Micro-Eye is a dual-conversion superheterodyne X-band and K-band detector. Although this article applies specifically to this particular model, other modern detectors may be usable, too.

Inside the Micro-Eye

The Micro-Eye is housed in a 1.25″ x 4.25″ x 4.5″ two-piece plastic case. Opening the case proved to be the most difficult part of the entire project! It's glued shut. Careful and persistent prying with a knife will separate the halves to reveal the high-quality electronics inside.

The detector's circuitry is divided between two printed circuit boards. One board contains the controller section of the detector (not used for this project). The other contains all of the RF circuitry and a horn antenna. These two boards conveniently plug together via a 6-pin connector. See Photos B and C.

The controller printed circuit board contains a couple of comparator ICs (MC3302 and LM393), an LM358 dual op amp, and a 78L05 voltage regulator. A custom controller chip appears in the center of the board. About 60 discrete components round out the circuitry.

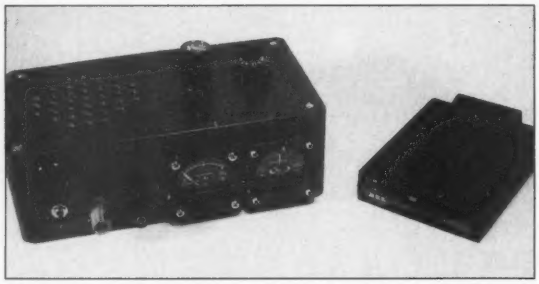

Photo A. The finished product (left) and the original radar detector (right).

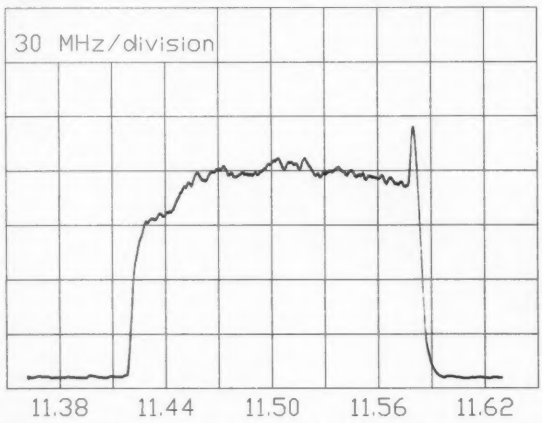

Figure 1. This plot shows the detector's VCO sweeping from 11.4 GHz to 11.6 GHz.

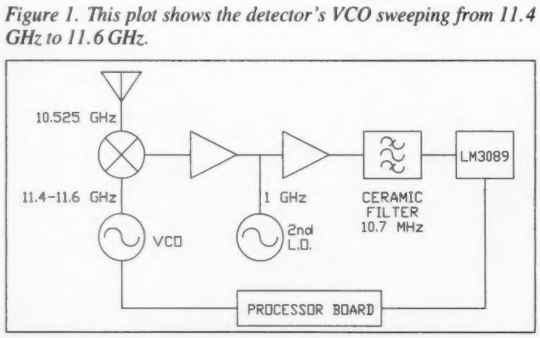

Figure 2. Block diagram of the radar detector.

Metalized, molded plastic covers most of the RF circuit board and forms three sides of the horn antenna. The circuit board itself serves as the fourth side. Some sections of the metalized plastic also provide shielding for the microwave circuitry. A dozen screws fasten the plastic cover to the circuit board. Photo B shows the detector's RF circuit board and metalized plastic horn.

Removing the cover reveals that the microwave circuitry is actually on a third daughterboard, previously hidden underneath (see Photo C). The tiny dimensions of the etched microstrip lines testify to the very high frequencies involved. There are two SOT packaged transistors and a mixer diode in a "beam-lead" package. The mixer diode is incredibly small—only about 0.01″ square! Use great care when handling circuit boards with such minuscule devices.

How It Works (More or Less)

Of course, the radar detector instructions didn't include a schematic or theory of operation. Snooping, just plain guessing, and a spectrum analyzer helped me ascertain how this device worked, and whether it could be useful to the microwave experimenter.

Experience dictates that if this is a superheterodyne receiver, it may well radiate some of its local oscillator('s) energy. And sure enough, it does. I pointed a small X-band horn on the input of the spectrum analyzer (a Hewlett-Packard 8551B with a 8441A pre-selector) at the horn of the radar detector and picked up a weak signal sweeping between 11.4 GHz and 11.6 GHz (see Figure 1). The sweep rate was about 40 hertz, but it turns out that this was not the only local oscillator involved.

If this device is meant to receive signals around 10.525 GHz, then there may well be an IF between 11.4 GHz minus 10.525 GHz, and

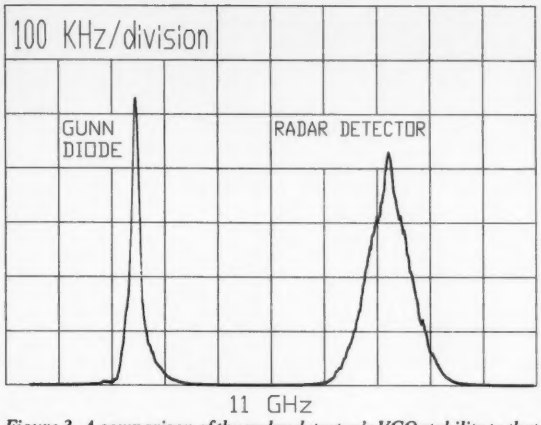

Figure 3. A comparison of the radar detector's VCO stability to that of a Gunn diode oscillator.

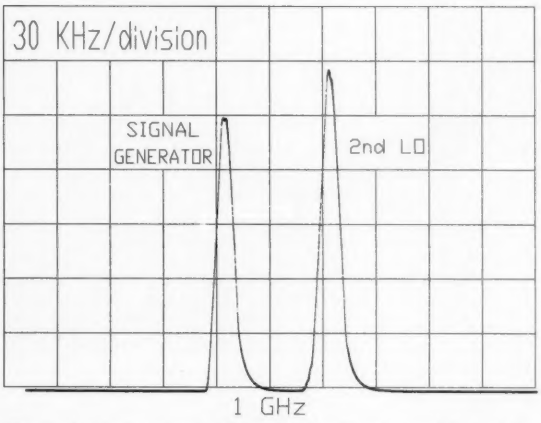

Figure 4. A comparison of the radar detector's second LO stability to that of a signal generator.

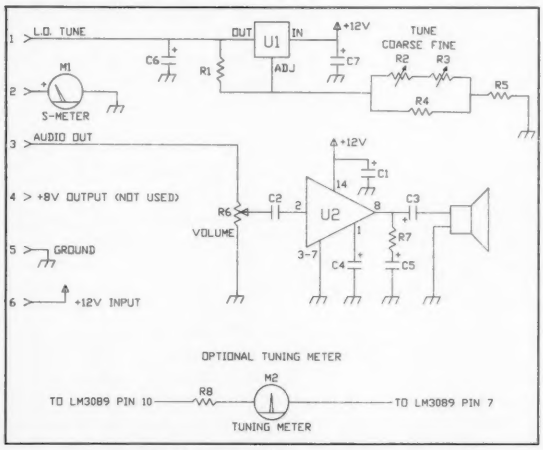

Figure 5. Schematic of the new circuit board.

11.6 GHz minus 10.525 GHz. "Sniffing" around the circuit board with the spectrum analyzer revealed a strong signal at about 1 GHz. This "second LO" signal was not swept in frequency.

Further examination revealed a welcome sight: a standard LM3089 FM Receiver IF System chip! Now here is something familiar with a 10.7 MHz input, an audio output, along with provisions for an S-meter and AFC. The input of the LM3089 is preceded by a 10.7 MHz ceramic filter which in turn is preceded by a couple of what appear to be microwave transistors. The first transistor amplifies the 1 GHz signal from the microwave circuit board and passes it on to the second transistor, which is also fed by the 1 GHz second LO, mixing the received signal down to 10.7 MHz (see Figure 2 and Photo C).

The 1 GHz second local oscillator is a TO-92 packaged transistor, while the first LO is comprised of the two SOT packaged transistors on the microwave daughterboard. This first LO, of course, is actually a VCO (Voltage Controlled Oscillator.)

Actually, the VCO probably generates RF at a lower frequency, the 11 GHz being harmonically generated in the mixer diode. With so many signals, and their possible mixes, it's hard to be sure even with the aid of a spectrum analyzer. The VCO/mixer diode combination also probably generates signals from 22.8 GHz to 23.2 GHz for the reception of K-band speed radars. The sweeping of the first LO frequency is probably done to make sure that any and all signals in the two radar bands are detected, and to make critical RF stage alignment unnecessary. A clever approach.

Modifying the Detector

The presence of the LM3089 FM IF chip hints that the radar detector might be easily adaptable to reception of Amateur Radio Service 10 GHz FM signals, such as those generated by M/A-Com Gunnplexers or Solfan transceivers. Two things still must be done: 1) Stop the first LO from sweeping and make it tunable. 2) Determine if the two LOs have sufficient purity and stability.

It turns out to be quite easy to accomplish

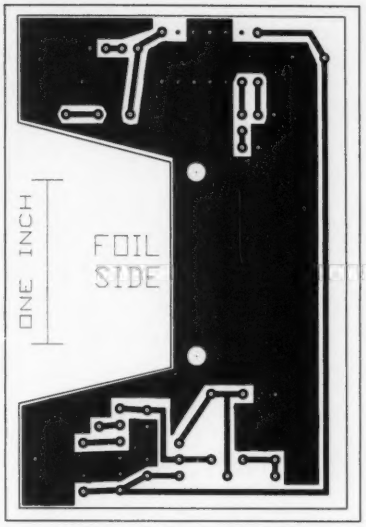

Figure 6. Foil side of the PCB.

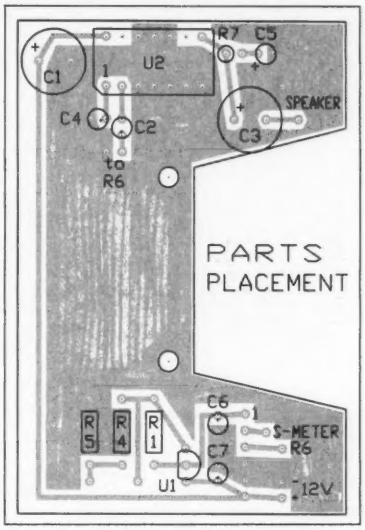

Figure 7. Parts layout.

the first item. The first LO is powered through one of the pins of the 6-pin connector that connects the RF and controller boards. If that pin is bent so that it doesn't mate with the connector, a variable bench supply can be hooked to it. In my unit, a 3.64 volt DC input made the VCO generate 11.5 GHz, while 5.9 volts yielded 11.0 GHz. The VCO drew only about 1 mA.

To check for purity, I observed the first LO signal on the spectrum analyzer side-by-side with a signal generated by a Gunn diode oscillator tuned a few kHz away. Although a Gunn diode signal might not be considered a paragon of purity, it does provide a valid guide, especially since the radar detector will be receiving Gunn diode signals in its new life. Figure 3 shows the result. The first LO signal on the right is much broader than the Gunn diode signal on the left. This is not good.

Note that the significant "pulling" effect of moving one's hand in front of a Gunn diode

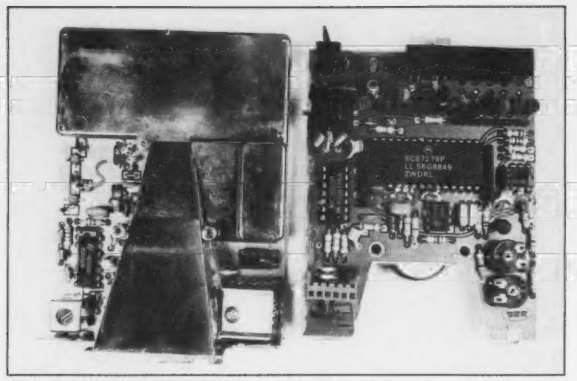

Photo B. Inside the radar detector. RF board on the left. Controller board (not used) on the right.

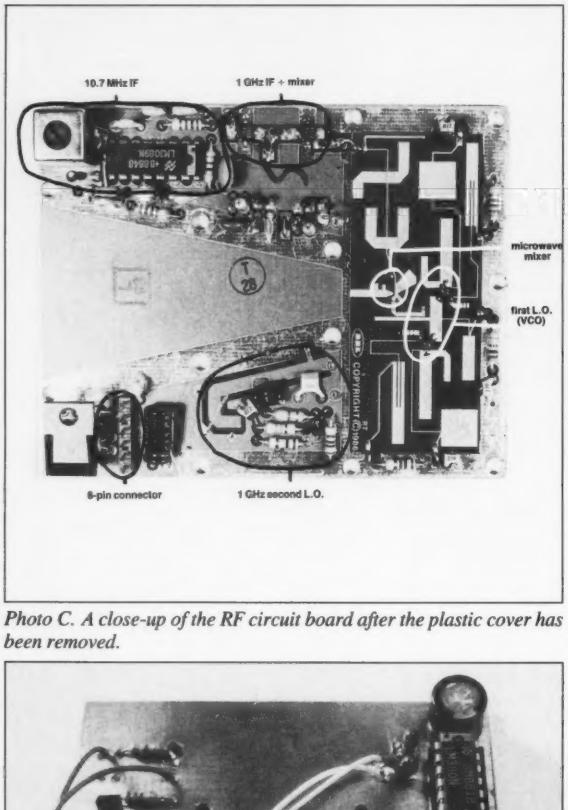

Photo C. A close-up of the RF circuit board after the plastic cover has been removed.

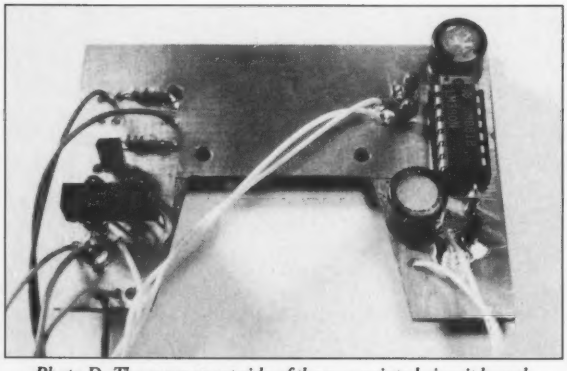

Photo D. The component side of the new printed circuit board.

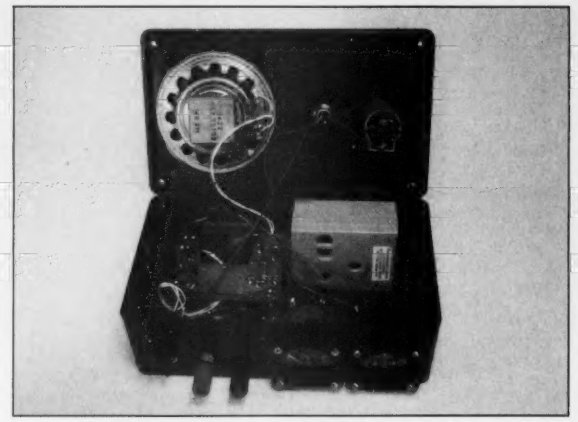

Photo E. The finished unit with the cover open.

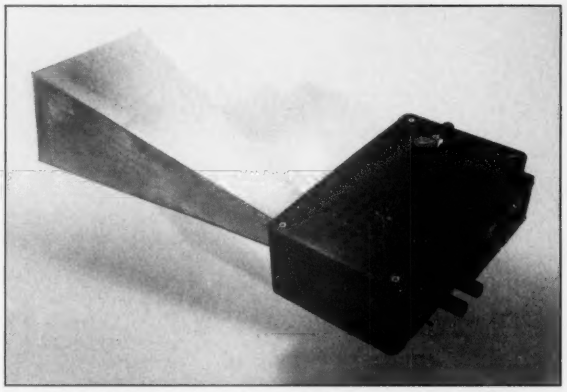

Photo F. The finished unit with the horn extension installed.

transmitter horn is absent in the radar detector. The first L.O. is noisy, but reasonably stable.

The 1 GHz second LO signal is much more acceptable. In Figure 4, the 1 GHz LO signal (right) is identical to the signal from a TS-419/U signal generator (left).

At this point we know that the radar detector can receive FM signals due to the presence of the LM3089 IC. Also, it can be tuned to receive in the amateur portion of X-band by powering the VCO used as the first LO with a variable power supply. The question remaining is whether the first LO signal is good enough to receive clear signals from the kinds of transmitters most amateurs presently use on microwave. The easiest check is to just try it.

Checkout

I have had an X-band beacon in continuous operation from a local mountaintop for some 10 years (see my article, "X-band Beacons," in the January 1987 issue of *Ham Radio*). Reception of a familiar, real-world, "known" signal from this beacon would prove the capability of the radar detector.

I rigged up a perfboard circuit with an LM317 variable voltage regulator and an audio amplifier (see Figure 5). This perfboard replaced the detector's controller circuit board. The LM317 circuit used a 10-turn pot for voltage adjustment. This circuit was designed to cover 3.64–5.9 volts, or 11.0 GHz–11.5 GHz, out of the VCO. The audio amplifier, an LM380, was connected to the audio output of the RF board's LM3089. Time for a DXpedition!

At a convenient location near my house, about 10 miles from the beacon, I can get a solid signal. I parked there and just pointed the modified detector through the car window and slowly turned the 10-turn pot—and there was the beacon's MCW ID signal! It wasn't strong, but it was surprisingly stable. And this is using only the radar detector's tiny horn for the antenna. I was sold on the fact that a modified police radar detector should make a great microwave bench-servicing tool and portable field-test receiver.

Further tests performed on the bench revealed that the modified radar detector produced usable audio when receiving signals from my M/A-Com Gunnplexer transceivers. It was also sensitive enough to pick up the 10 GHz calibration signal of a 1N23 diode driven by a 2 meter handheld (see "X-band Calibrator" in the April 1981 issue of *Ham Radio*).

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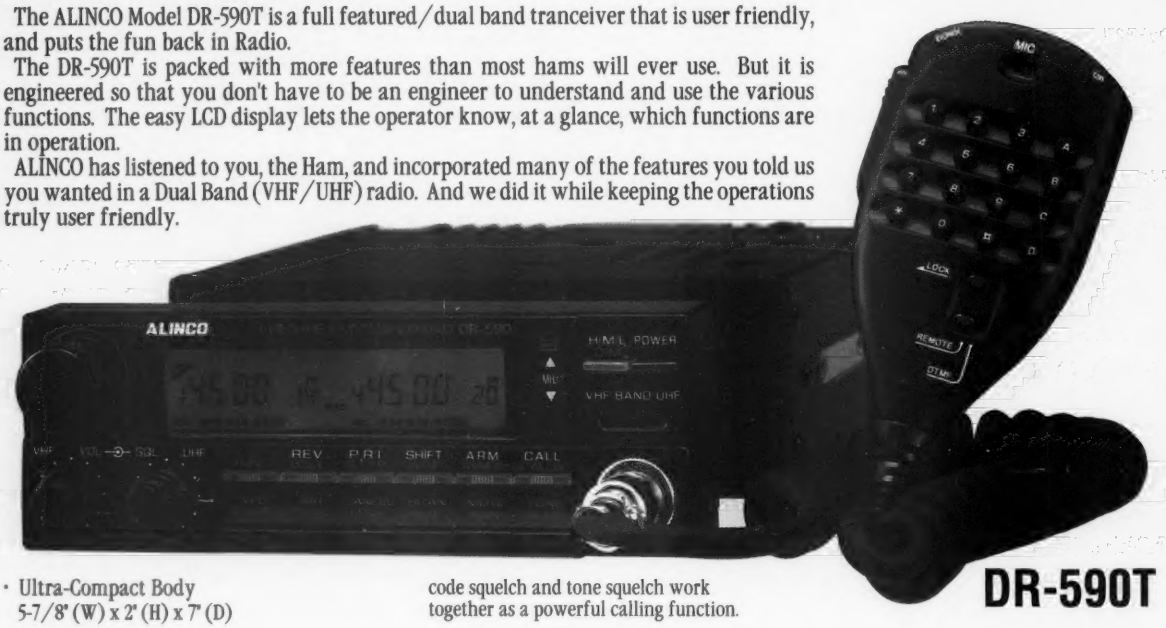

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The Final Design

The next step is to tidy up the circuitry, especially the added audio amplifier. Perfboard is not a good medium for high gain amplifiers of any frequency. A printed circuit board's solid groundplane helps keep unwanted oscillations and feedback under control (see Photo D and Figures 6 & 7). Two 10-turn pots with counting dials are very desirable for tuning the VCO. One, R2, serves as coarse tune. The other, R3, is fine tune. R4 and R5 set the range of voltage available. The values shown allow tuning through the entire amateur X-band (10.0 GHz–10.5 GHz).

These values may have to be adjusted to each particular Micro-Eye receiver. Be sure to test the final circuitry before plugging the new circuit board into the radar detector RF circuit board. Note that microphonics, or vibration-induced feedback, may be introduced if the speaker is mounted too close to the molded plastic shield. An S-meter, a zero-center tuning meter, and a frequency meter are optional add-on's.

The new circuit board can use the 6-pin connector that was removed from the unused controller circuit board. The optional zero-center tuning meter wires directly to pins 7 and 10 of the LM3089. The result is a circuit board that plugs into the Micro-Eye RF board, replacing the original controller board.

Packaging is up to you. I found that everything, including a NiCd battery, fit nicely in a 7″ x 4″ x 3″ plastic box (see Photo E).

Parts List

Capacitors, all 16 WVDC or better.

C1	25 µF electrolytic or tantalum
C2	0.1 µF
C3	100 µF electrolytic or tantalum
C4	4.7 µF electrolytic or tantalum
C5	0.1 µF
C6	1 µF electrolytic or tantalum
C7	1 µF electrolytic or tantalum

Resistors.

R1	220 ohm ¼-watt fixed
R2	1k 10-turn pot (coarse tune)
R3	100 ohm 10-turn pot (fine tune)
R4	680 ohm ¼-watt fixed
R5	390 ohm ¼-watt fixed
R6	10k pot (volume)
R7	2.3 ohm ¼-watt fixed

Semiconductors.

U1	LM317L variable voltage regulator
U2	LM380N audio amplifier

Miscellaneous.

M1	S-meter, 100 µA movement
1	6-pin connector (remove from unused controller circuit board)
2	ten-turn counting dials
1	8 ohm speaker
1	PC board

Note: A blank PC board is available from FAR Circuits, 18N640 Field Court, Dundee IL 60118 for $6 + $1.50 shipping/handling.

Optional, for center-tune meter.

M2	100 µA zero-center meter
R8	4.7k ¼-watt fixed

Horn Antenna Extender

The Micro-Eye presents a bit of a problem if you want to change the antenna. Its antenna is rather closely integrated into the entire RF board design. You don't have a handy coax connector or waveguide flange to hook things to. Its horn does work quite nicely, and would probably make a satisfactory feed for a 1′ to 3′ dish.

As an experiment, I made an extension to the integral molded horn, fashioning it from double-sided copper-clad printed circuit board. The extension sleeves inside of the existing horn (see Photo F).

Remember: *You must be very careful not to touch the mixer diode located inside of the horn!*

This extension adds an estimated 8 dB of gain. Field tests verified a marked improvement in signal strength.

You could try modifications I didn't attempt, such as adding an AFC (Automatic Frequency Control), or replacing the horn antenna with an adaptor to a standard waveguide flange or coax connector. The latter modification would allow measurement of the noise figure of the receiver.

The BEL Micro-Eye police speed radar detector is easily modified for reception of the 10 GHz ham band. The cost is low and the performance is quite respectable. This device should serve as a useful accessory for the microwave amateur. 73

You may contact Steve J. Noll WA6EJO at 1288 Winford Avenue, Ventura CA 93004-2504.

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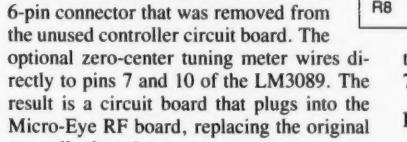

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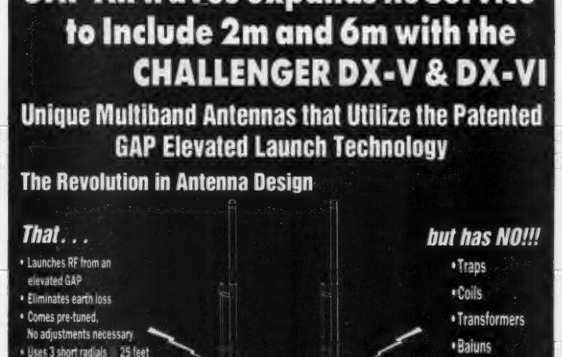

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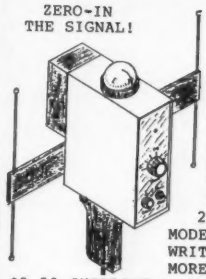

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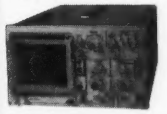

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Specifications:

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Speed:	20 ch/sec. scan. 40 ch/sec. search
IF:	561.225, 58.075, 455KHz or 10.7MHz
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Audio:	.4 Watts
Power:	Input 9 - 13.8 V. DC
Antenna:	BNC
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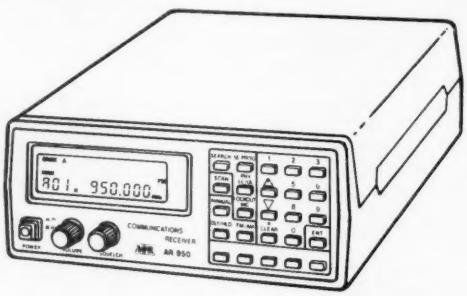

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Scan Speed:	15 ch/sec.
IF:	21.4MHz, 455KHz
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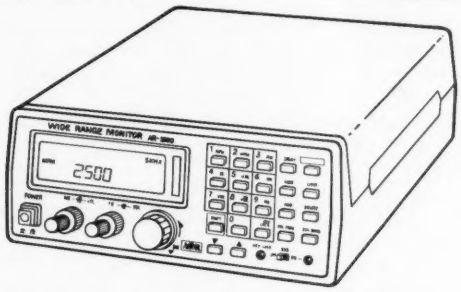

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- One Year Limited Warranty.

Options:

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Mobile Mounting Bracket.	MM1	$14.90
RS232 Control Package (software & cable) offers spectrum display and database.	SCS2	$295.00

Specifications:

Coverage:	1 MHz - 1500MHz
Sensitivity:	.35uV NFM, 1.0uV WFM, 1.0AM/SSB/CW
Speed:	38 ch/sec. scan. 38 ch/sec. search
IF:	750.00, 45.0275, 5.5MHz 455KHz
Increments:	5,12,5,25 KHz
Audio:	1.2 Watts at 4 ohms
Power:	Input 13.8 V. DC 300mA
Antenna:	BNC
Display:	LCD, backlighted.
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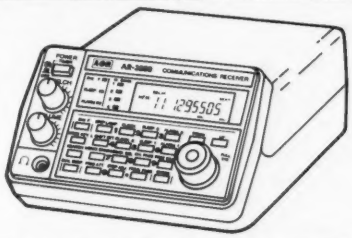

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RS232 Control Package (software & cable) offers spectrum display and database.	SCS3	$295.00

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Coverage:	100KHz - 2036MHz
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Speed:	20 ch/sec. scan. 20ch/sec. search
IF:	736.23, (352.23) (198.63) 45.0275, 455KHz
Increments:	50Hz and greater
Selectivity:	2.4Khz/-6db (SSB) 12KHz/-6db (NFM/AM)
Audio:	1.2 Watts at 4 ohms
Power:	Input 13.8 V. DC 500mA
Antenna:	BNC
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UHF Source Dipper

The easy way to tune circuits from 400–500 MHz!

by Martin Beck WBØESV

Most amateurs who have used or tried to build a 432 MHz dip meter are familiar with the problem of the inductor being so small that it is useless for getting into UHF circuitry. All the so-called solutions I have seen are either clumsy ("I need three hands!") or mechanically unstable. The device described here solves all of these problems, as well as several others. It is small, inexpensive, unusually accurate, and a beginner can build it in four hours.

As the design emerged, I refused to budge from two requirements. The first was that the hairpin inductor be no shorter than 1¼". Second, I wanted a physical layout such that I could look at the tuning dial and, without moving my eyes, see the hairpin loop as it entered the circuitry being dipped. That meant having the loop on one end and the dial on the other. As you can see from Figure 3, this layout is particularly conducive to good UHF wiring techniques, resulting in a very handy little dipper that tunes from 400–500 MHz.

The three figures here show the construction process of the dipper. Note that the holes for the capacitor and extension shaft must line up for smooth tuning, and the brass mounting plate must fit the box you use.

In wiring this circuit, use very short, near zero lead length—this is crucial. (Figure 2 shows a blown-up version with too long lead lengths, simply for clarity.) Cut out and bend the brass plate to fit your box. Then use the actual components (capacitors, resistor, etc.) to aid you in punching the holes for everything. This is the best way to avoid excessive leads around the oscillator circuit.

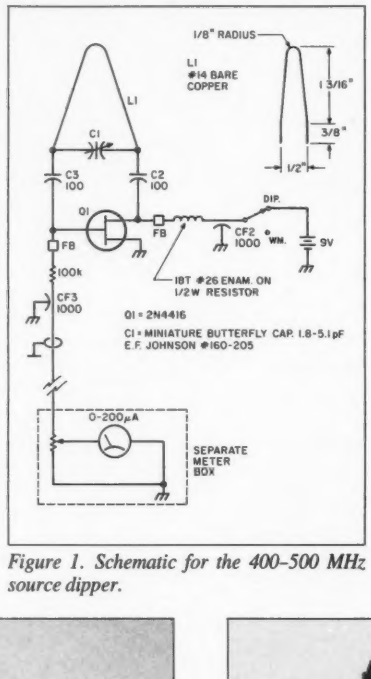


Figure 1. Schematic for the 400–500 MHz source dipper.

I was lucky enough to have an old National Co. ceramic FT-243 crystal socket. Teflon™, phenolic, etc. are OK. Unless you are an experienced VHFer, don't use a metal box. If you do, disaster awaits you! For convenience in replacing the battery, I bought a package of

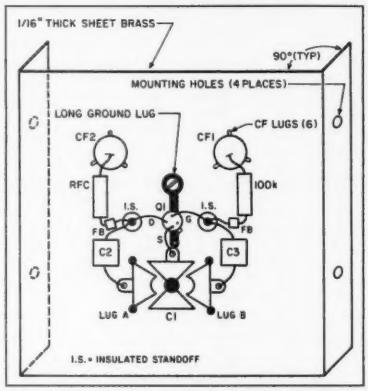


Figure 2. Details of the oscillator mounting plate (not to scale). Lead lengths are shown excessively long for clarity. Very short, near zero leads are mandatory. Note: The two pins on the crystal socket (hairpin coil socket) are soldered directly to lugs A and B. The long ground lug and Q1 source are soldered to the C1 grounding lug. Solder the feedthrough cap shields to the plate.

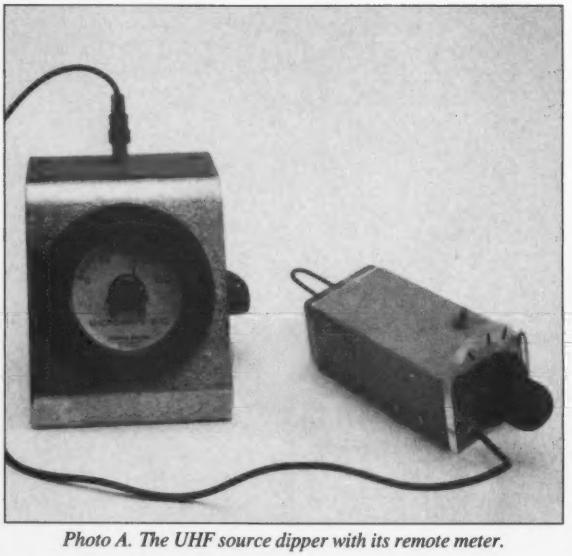


Photo A. The UHF source dipper with its remote meter.

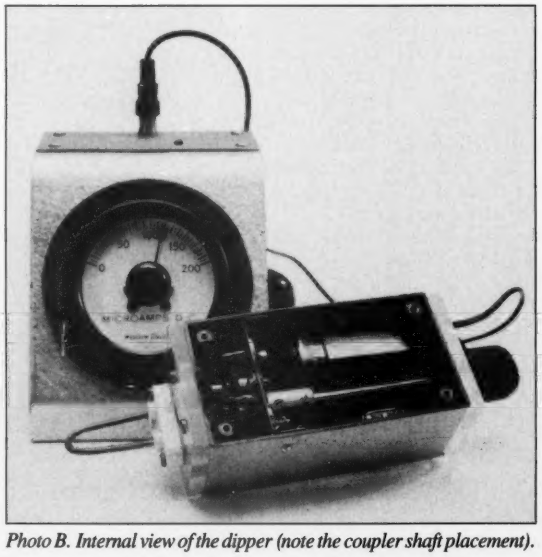


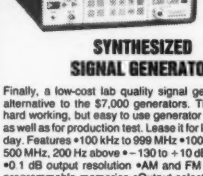
Photo B. Internal view of the dipper (note the coupler shaft placement).

RAMSEY ELECTRONICS

COM-3
$279.00

2 WAY RADIO SERVICE MONITOR

COM-3, the world's most popular low-cost service monitor. For shops big or small, the COM-3 delivers advanced capabilities for a fantastic price—and our new lease program allows you to own a COM-3 for less than $3.00 a day. Features •Direct entry keyboard with programmable memory •Audio & transmitter frequency counter •LED bar graph frequency/error deviation display •0.1–10.000 µV output levels •High receive sensitivity, less than 5 µV •100 kHz to 999.9995 MHz •Continuous frequency coverage •Transmit protection, up to 100 watts •CTS tone encoder, 1 kHz and external modulation.



RSG-10
$249.00

SYNTHESIZED SIGNAL GENERATOR

Finally, a low-cost lab quality signal generator—a true alternative to the $7,000 generators. The RSG-10 is a hard working, but easy to use generator ideal for the lab as well as for production test. Lease it for less than $3.00 a day. Features •100 kHz to 999 MHz •100 Hz resolution to 500 MHz, 200 Hz above •–130 to +10 dBm output range •0.1 dB output resolution •AM and FM modulation •20 programmable memories •Output selection in volts, dB, dBm with instant conversion between units •RF output reverse power protected •LED display of all parameters—no analog guesswork!

FREQUENCY COUNTERS

CT-70 7 DIGIT 525 MHz | **CT-90 9 DIGIT 600 MHz** | **CT-125 9 DIGIT 1.2 GHz**

Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one-year warranty on parts and labor. We take great pride in being the largest manufacturer of low-cost counters in the entire U.S.A. Compare specifications. Our counters are full-featured, from audio to UHF, with FET high impedance input, proper wave shaping circuitry, and durable high quality epoxy glass plated-thru PC board construction. All units are 100% manufactured in the U.S.A. All counters feature 1.0 ppm accuracy.

NEW CT-250 2.5 GHZ

ACCESSORIES FOR COUNTERS

Telescopic ship antenna—BNC plug, WA-10	$11.95
High impedance probe, light loading, HP-1	$16.95
Low-pass probe, audio use, LP-1	$16.95
Direct probe, general purpose use, DC-1	$16.95
Tilt bail, elevates counter for easy viewing, TB-70	$ 9.95
Rechargeable internal battery pack, BP-4	$ 9.95
CT-90 oven timebase, 0.1 ppm accuracy, OV-1	59.95

ALL COUNTERS ARE FULLY WIRED & TESTED

MODEL	FREQ. RANGE	SENSITIVITY	DIGITS	RESOLUTION	PRICE
CT-50	20 Hz–600 MHz	< 25 mV to 500 MHz	8	1 Hz, 10 Hz	$189.95
CT-70	20 Hz–550 MHz	< 50 mV to 150 MHz	7	1 Hz, 10 Hz, 100 Hz	$139.95
CT-90	10 Hz–600 MHz	< 10 mV to 150 MHz < 150 mV to 600 MHz	9	0.1 Hz, 10 Hz, 100 Hz	$169.95
CT-125	10 Hz–1.25 GHz	< 25mV to 50 MHz < 15 mV to 500 MHz < 100 mV to 1 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$189.95
CT-250	10 Hz–2.5 GHz typically 3.0 GHz	< 25 mV to 50 MHz < 10 mV to 1 GHz < 50 mV to 2.5 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$239.95
PS10B Prescaler	10 MHz–1.5 GHz, divide by 1000	< 50 mV	Convert your existing counter to 1.5 GHz		$89.95

SPEED RADAR
$89.95 complete kit SG-7

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual doppler shift. Uses two 1-lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. Kit includes delivery. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

BROADBAND PREAMP

Boost those weak signals to your scanner, TV, shortwave radio or frequency counter. Flat 25 dB gain, 1 to 1000 MHz. 3 dB NF. BNC connectors. Runs on 12 VDC or 110 VAC.
PR-2, wired, includes AC adapter $59.95

2M POWER AMP

Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.
PA-1, 40W pwr amp kit $29.95
TR-1, RF sensed T-R relay kit . $ 8.95

FM WIRELESS MIKE KITS

FM-3 SHOWN

Pick the unit that's right for you. All units transmit stable signal in 88–108 MHz FM band up to 300' except for hi power FM-4 that goes up to ½ mile.
FM-1, basic unit ..... $ 5.95
FM-2, as above but with added mike preamp ..... $ 7.95
FM-4, long range, high power with very sensitive audio section, picks up voices 10' away $14.95
FM-3, complete unit includes case, battery, switch, antenna, and built-in condensor mike. Excellent fidelity, very small, kit $16.95
FM-3WT, as above, but fully wired and tested $19.95
SMC, miniature sensitive mike cartridge for FM-1, 2, 4 ..... $ 2.95

MICROWAVE INTRUSION ALARM

A real microwave Doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz, and is not affected by heat, light, or vibrations. Drives up to 100 mA output, normally open or closed, runs on 12 VDC.
Complete kit MD-3 . $16.95

MUSIC MACHINE

Neat kit that will produce 25 different classical and popular tunes, plus 3 doorchime sounds. Lots of fun for doorbells, shop, or store entrances, car horn, music boxes, etc. Runs on 9V battery or wall transformer. Excellent speaker volume and adjustable tempo and pitch. Add our case set for a handsome finished look.
Complete kit, MM-5 ..... $24.95
Case + knob set, CMM-5 . $12.95

PACKET RADIO

Commodore C64/128 packet radio interface. Uses famous German Digicom software. Features EXAR IC chip set for reliable operation—runs HF or VHF tones. Includes FREE disk software. PC board, all necessary parts and full documentation.
Complete kit, PC-1 .... $49.95

LO NOISE PREAMPS

Make that reciever come ALIVE! Small size for easy installation with Hi-Q tuned input for peak performance. Excellent gain and noise figure—guaranteed to improve reception! Specify band: 2M—PR-10, 220 MHz—PR-20, 440 MHz—PR-40.
Each kit $17.95

TONE DECODER

A complete tone decoder on a single PC board. Features: 400–5000 Hz adjustable range via 20-turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
Complete kit, TD-1 . $5.95

VOICE ACTIVATED SWITCH

Voice activated sional kit provides switched output with current capability up to 100 mA. Can drive relays, lights, LED, or even a tape recorder motor. Runs on 9 VDC.
VS-1 kit. $6.95

TELEPHONE TRANSMITTER

Mini-sized with professional performance. Self-powered from phone line, transmits in FM broadcast band up to ¼ mile. Installs easily anywhere on phone line or inside phone!
PB-1 kit $14.95

TICKLE STIK

A shocking kit! Blinking LED attracts victims to pick up innocent-looking can—you watch the fun! Ideal for office desks, parties, nosey know-it-alls!
TS-4 kit $9.95

TV TRANSMITTER

Transmit your VCR or TV camera throughout your house. Stable quality signal, tunable Ch 4–6. Accepts standard video and audio inputs.
Complete kit,
JM-7 ..... $14.95

COLOR ORGAN

See music come alive! 3 different lights flicker with music. One light each for high, mid-range, and lows. Each individually adjustable and drives up to 300 W. Runs on 110 VAC.
ML-1 kit. $8.95

LIGHT BEAM COMMUNICATORS

Transmits audio over infrared beam up to 30'—use simple lenses to go up to ¼ mile! Hum free, uses 30 kHz carrier. Great for wireless earphones or undetectable "bug."
Transmitter + receiver set, LB56 . . $19.95

FM RADIO

Full-fledged superhet, microvolt sensitivity, IC detector and 10.7 MHz IF. Tunes Std. FM broadcast band as well as large portions on each end. Ideal for "bug" receiver, hobby experiments or even as FM radio!
FR-1 kit $14.95

SUPER SLEUTH

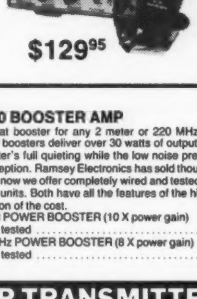
A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output. Runs on 6 to 15 volts, uses 8–45 ohm speaker.
BN-9 kit $5.95

BROADBAND PREAMP

Very popular sensitive all-purpose preamp, ideal for scanner, TVs, VHF/UHF rigs, counters. Lo noise, 20 dB gain, 100 kHz–1 GHz, 9V–12 VDC operation.
SA-7 kit $14.95

NEW FANTASTIC 2M FM TRANSCEIVER

SYNTHESIZED—NO CRYSTALS TO BUY!



$129.95

Ramsey breaks the price barrier on 2 meter rigs! Here's the ideal rig for field days, hamfests, vacations, second cars and packet (it even has dedicated packet connections). Six expandable diode-programmed channels, 5W RF output, sensitive dual conversion receiver and EASY assembly. Why pay more for a secondhand old rig when you can make your own for less. Have some fun with your own truly AMERICAN-MADE FM rig! This kit comes complete except for the case, mike and speaker—ICOM or equal speaker-mikes plug right in. Add our own beautiful case set for a professional factory look.
FTR-148 kit $129.95
FTR-148-C aluminum case & knob set $24.95

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Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz, units. Both have all the features of the high-priced boosters at a fraction of the cost.
PA-10 2 MTR POWER BOOSTER (10 X power gain)
Fully wired & tested $79.95
PA-20 220 MHz POWER BOOSTER (8 X power gain)
Fully wired & tested $79.95

QRP TRANSMITTERS HAM RECEIVERS

20, 30, 40, 80M CW TRANSMITTERS

Join the fun on QRP! Thousands of these mini-rigs have been sold and tons of DX contacts have been made. Imagine working Eastern Europe with a $30 transmitter—that's ham radio at its best! These CW rigs are ideal mates to the receivers at right. They have two-position variable crystal control (one popular QRP XTAL included), one watt output and built-in antenna switch. Runs on 12VDC. Add our matching case and knob set for a handsome finished look.
Your choice of bands $29.95
(Specify band: QRP-20, 30, 40 or 80)
Matching case & knob set, CQRP $12.95

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Build your own mini ham station. Sensitive all-mode AM, CW, SSB receivers use direct conversion design with NE602 IC as featured in *QST* and ARRL handbooks. Very sensitive varactor tuned over entire band. Plenty of speaker volume. Runs on 9V battery. Very EASY to build, lots of fun and educational—ideal for beginner or old pro. New 30-page manual. Add the case set for well-fitted professional look.
Your choice of bands $27.95
(Specify band: HR-20, HR-30, HR-40, HR-80)
Matching case & knob set, CHR $12.95

E-Z KEY CMOS KEYER

Send perfect CW within an hour of receiving this kit! Easy-to-build kit has sidetone oscillator, speed control and keys most any transmitter. Runs for months on a 9V battery. 28-page manual gives ideas on making your own key for extra savings. Add our matching case set for complete station look.
CW-7 kit $24.95
Matching case knob set, CCW $12.95

ACTIVE ANTENNA

Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!
AA-7 Kit $24.95
Matching case & knob set, CAA $12.95

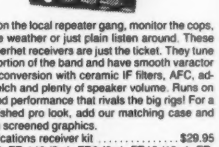
SPEECH SCRAMBLER

Communicate in total privacy over phone or radio. Kit features full duplex operation using frequency inversion. Both mike and speaker or line in/out connections. Easy hookup to any radio, and telephone use requires no direct connection! Easy to build 2 IC circuit. Can also be used to descramble many 2-way radio signals. Finish your kit off with the handsome case & knob set.
SS-7 kit $29.95
Matching case & knob set, CSS $12.95

SHORTWAVE RECEIVER

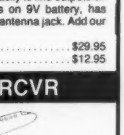
Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4–11 MHz. True superhet has smooth varactor tuning, AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3–22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!
Shortwave receiver kit, SRI $27.95
Shortwave converter kit, SCI $24.95
Matching case set for SRI, CSR $12.95
Matching case set for SCI,CSC $12.95

2, 6, 10 MTR, 220 FM RECEIVERS



Keep an ear on the local repeater gang, monitor the cops, check out the weather or just plain listen around. These sensitive superhet receivers are just the ticket. They tune any 5 MHz portion of the band and have smooth varactor tuning, dual conversion with ceramic IF filters, AFC, adjustable squelch and plenty of speaker volume. Runs on 9V battery and performance that rivals the big rigs! For a complete finished pro look, add our matching case and knob set with screened graphics.
FM communications receiver kit $29.95
Specify band: FR 146 (2m), FR6 (6m), FR10 (10m), FR-220 (220 MHz)
Matching case & knob set, CFR $12.95

FM STEREO TRANSMITTER



Run your own stereo FM station! Transmit a stable signal in the standard FM broadcast band throughout the house, dorm or neighborhood. Connects easily to line outputs on CD player, tape decks, etc. Runs on 9V battery, has internal whip antenna and external antenna jack. Add our case set for a "station" look!
FM-10 kit $29.95
Matching case set, CFM $12.95

AIRCRAFT RCVR

Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110–136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.
AR-1 kit $24.95
Matching case set, CAR $12.95

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This General course includes 6 tapes for speed building from 5 to 13 wpm.

#08B COMPLETE ADVANCED $62.95
This Advanced course includes 4 theory tapes, 1 textbook, and 6 code tapes (13 to 22 wpm).

#09 ADV. THEORY COURSE $32.95
4 tapes and 1 illustrated textbook

#10 COMPLETE EXTRA. . . . $62.95
4 theory tapes, 1 textbook, and 6 code tapes (13 to 22 wpm).

#12 EXTRA THEORY COURSE $32.95
4 theory tapes and 1 illustrated textbook for Extra class theory.

#11 EXTRA CODE COURSE $32.95
6 tapes for speed building from 13 to 22 wpm for the Extra code exam.

#13 BRASS KEY & OSC. . . . $25.95

#15 PLASTIC KEY & OSC. . . $21.95

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#23 10 wpm Plateau Breaker
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#26 13 wpm Random Code
#27 13 wpm Test Preparation
#28 13 wpm Car Code
#29 13-15 wpm Speed Builder
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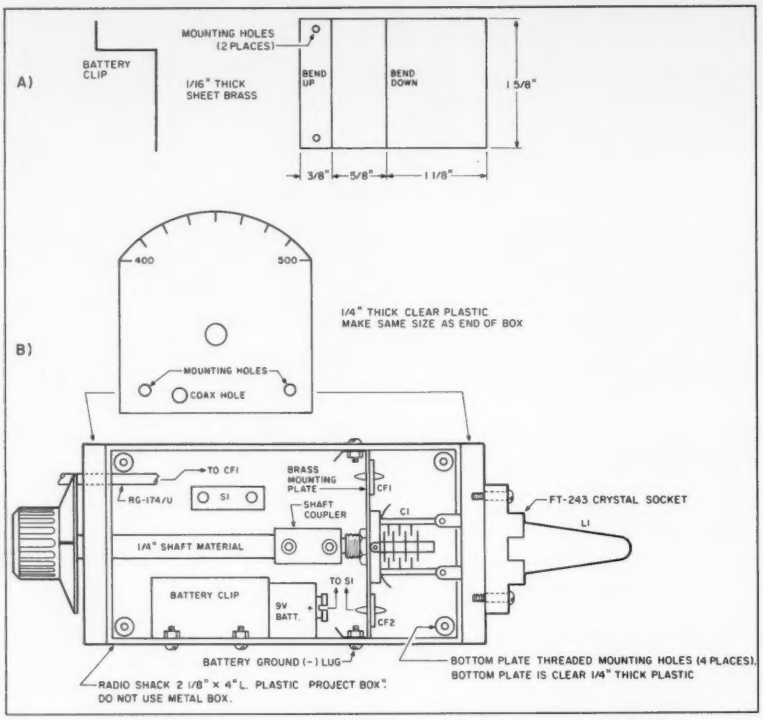

Figure 3. Battery clip (a) and bottom view showing parts placement (b).

Parts List

Q1	2N4416 transistor	
C1	1.8–5.1 pF miniature butterfly capacitor	(Cardwell #160–205)*
C2,C3	100 pF ceramic capacitor	
CF1,CF2	1000 pF feedthrough capacitor	
FB	Ferrite beads (2)	
M1	0–200 μA meter	
BT1	9 volt transistor battery	
SW1	SPDT switch	

Misc. components:
Length of RG-174/U mini-coax. Chassis for meter. 1/16" thick brass sheet.
Short length of #14 bare copper wire. FT-243 style XTAL socket.
*C1 available from Radiokit, P.O. Box 973, Pelham, NH 03076. Phone: (603) 635-2235.

snap-on 9 volt battery clips (with wires) from Radio Shack. Since most commercial or home-brew shaft couplers are ¼" in diameter, and C1 has a slightly smaller shaft, you can use a small piece of brass shim stock to mate the capacitor shaft to the ¼" coupler.

Below and left of the tuning knob is a small hole through which the coax is passed to the external meter. I used RG-174/U because it is limp and does not fight you as you move the dipper around.

Now, about calibration. You will be in the ballpark if you match my construction. However, it would only take a few minutes with a 500 MHz frequency counter. The dipper is totally portable so that you can take it to the counter. At any rate, it should be calibrated with reasonable accuracy initially. My unit holds its calibration exceedingly well. The range is shifted by lengthening or shortening L1. No other adjustment exists or is needed.

Since the wavemeter position is used in "hot" circuits, a piece of snug-fitting insulating tubing must be used over L1. I first used heat-shrink tubing, and then scrounged around for an appropriate size of Teflon tubing to go over it. It makes sense to use some other, safer device if you insist on measurements around high-voltage circuits!

Once you have this dipper built and calibrated, you will find it invaluable as a time-saver when making any sort of 400–500 MHz tank circuits. With no AC source required, it can be taken and used anywhere. Battery drain is only a few mils, so replacing the battery is a rare event.

This is the handiest, most accurate 432 dipper I have seen. Along with my UHF field strength meter (in this issue), it allows me to zip painlessly through my 432 projects. 73

Contact Martin Beck WB0ESV at 1637 Hood, Wichita KS 67203.

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TS440S/AT, R-5000, TS-850S, TM 241A/441A, TM-2550A, TR-751A, Kenwood Service Repair, TM-731A, TS-711/811A, TH205AT, TH225A, TM-631A, TM-331A, TS140S, TS680S, RZ-1, TS-790A, TS950SD, TH-77A, TH27/47A, TM-941A

AMPLIFIERS STOCKED: RF Concepts Mirage TE Systems

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FTH-2008/7008 IC2/4GAT/24AT
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MARINE ICOM: M5, M56, M700
AVIATION ICOM: A20 H.T., TAD

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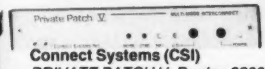
Simplex Autopatch SDI-50 Will Patch FM Transceiver To Your Telephone. Great For Telephone Calls From mobile To Base. Simple To use. SDI-50, SSI-68.



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PRIVATE PATCH V, Duplex 8200, CS700

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AOR, AR-1000—wide range, hand held scanners

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2210 H, 0-2200 MHz, 2600H, UTC-3000

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CIRCLE 41 ON READER SERVICE CARD

UHF Field Strength Meter

For 400 to 500 MHz.

by Martin Beck WBØESV

This field strength meter will cover 400 to 500 MHz. I chose the tank components from several trial units, with the result that when tuning across an RF source within the design range, a very sharp upward kick of the meter occurs. Response is excellent at the design frequency, and extremely poor to nonexistent for nearby frequencies. If light coupling is used, the off frequency rejection is even better. The coupling is accomplished through a 1- to 2-foot length of RG-174/U mini coax, with a phono plug on one side and a small wire loop on the other.

Since we often deal with very weak 400–500 MHz energy, I have included a simple DC amplifier to drive the meter. The amplifier employs one transistor, with a potentiometer to vary its gain.

I calibrated my unit with my dip meter and a digital frequency counter of known accuracy. In a field strength meter (FSM) one should not expect frequency meter accuracy, but this one, with care in construction and calibration, can easily exceed what is generally necessary.

The schematic, drawings, and photos show all that is needed to build this device. Wiring associated directly with the tank circuit should emulate good VHF construction practices, use very short or near zero lead lengths.

Once your unit is completed and calibrated, you will find yourself being reassured that LO output really *is* on 404 MHz. For those who have no facilities for close calibration, the little 400–500 MHz dipper in this issue will do a good enough job for all but the most stringent situations. I "never really needed" a good 400–500 MHz FSM until I had one! I believe you will enjoy its help as much as I do. This FSM and its mate, the UHF source dipper (also in this issue) form a powerful pair that belongs on every VHF workbench. 73

Martin Beck WBØESV, 1637 Hood, Wichita KS 67203.

Photo A. The UHF field strength meter.

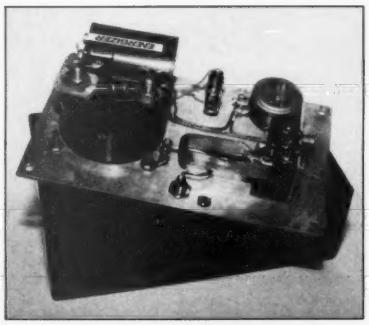

Photo B. Internal view of the meter.

Parts List

Q1	2N3906 or any small signal PNP transistor
D1	1N914 diode
C1	1.5–5.0 pF variable capacitor (Cardwell #160–102)*
C2	500 pF disc ceramic capacitor
C3,C4	680 pF disc ceramic capacitor
RFC1	7" #24 enameled wire 3.16" diameter close-wound with ⅛" leads.
L1	⅜" wide hobby brass strip 1/64" thick(see Figure 1)
L2	#14 bare copper wire (see Figure 1)
R1	10k potentiometer
R2	470 ohm resistor, ¼ watt
M1	0–200 μA (or 0–50 μA) meter
S1	SPST switch
BT1	9 volt battery

Misc. components: Project box (RS# 270-232), small brass sheet, two-terminal standoff.
*C1 available from Radiokit, P.O. Box 973, Pelham, NH 03076. Phone: (603) 635-2235.

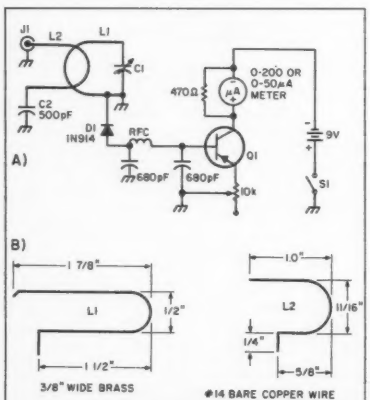

Figure 1. Field strength meter schematic.

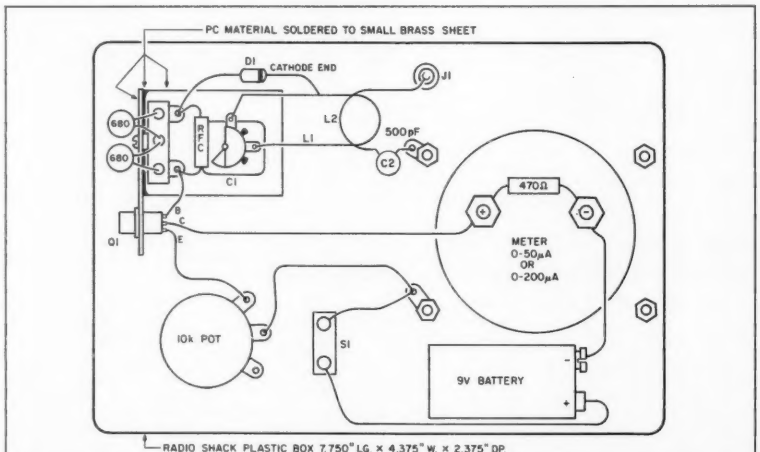

Figure 2. Parts layout for the field strength meter.

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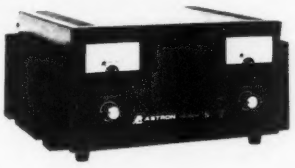


MODEL VS-50M

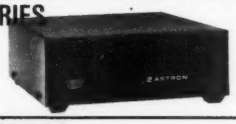
SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

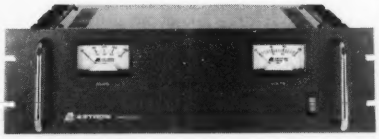


MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• LOW PROFILE POWER SUPPLY						
SL-11A	•	•	7	11	2¾ x 7⅝ x 9¾	11

RS-L SERIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE				
RS-4L	3	4	3½ x 6⅛ x 7¼	6
RS-5L	4	5	3½ x 6⅛ x 7¼	7

RM SERIES



MODEL RM-35M

• 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

VS-M AND VRM-M SERIES

MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

COMMUNICATIONS ELECTRONICS INC.

Emergency Operations Center has expanded to our new two acre facility and World Headquarters. Because of our growth, CEI is now your *one stop source* for emergency response equipment. When you have a command, control or communications need, essential emergency supplies can be rushed to you by CEI. As always, for over twenty two years, we're here and ready to help.

Our RELM two-way radio transceivers were especially created for government agencies. When you need to talk to police, fire, ambulance, or state, federal and international response forces, RELM transceivers may be quickly programmed for up to 48 frequencies. Listed below, are some of our most asked about transceivers. For additional assistance, call CEI at 313-996-8888.

NEW! RELM® RSP500-A

List price $465.00/**CE price $319.95/SPECIAL**
20 Channel • 5 Watt • Handheld Transceiver
Frequency range: 148-174 MHz. continuous coverage. Will also work 134-148 MHz. with reduced performance.
The *RELM* RSP500B-A is our most popular programmable 5 watt, 20 channel handheld transceiver. You can scan 20 channels at up to 40 channels per second. It includes CTCSS tone and digital coded squelch. Snap on batteries give you plenty of power. Additional features such as time-out timer, busy-channel lockout, cloning, plug-in programming and IBM PC compatability are standard. It is F.C.C. type accepted for data transmission and D.O.C. approved. We recommend also ordering the **BC45** rapid charge 1½ hour desk battery charger for $99.95, a deluxe leather case **LC45** for $48.95 and an external speaker microphone with clip **SM45** for $59.95. Since this radio is programmed with an external programmer, be sure to also order one **PM45** at $74.95 for your radio system.

NEW! RELM® UC102/UC202

List price $128.33/**CE price $79.95/SPECIAL**
Now...Handheld gear you can afford.
CEI understands that all agencies want excellent communications capability, but most departments are strapped for funds. To help, CEI now offers a special package deal on the RELM UC102 one watt transceiver. You get a UC102 handheld transceiver on 154.5700 MHz., flexible antenna, battery charger and battery pack for only $79.95. If you want even more power, order the RELM **UC202** two watt transceiver for only $114.95.

NEW! RELM® RH256NB-A

List price $449.95/**CE price $299.95/SPECIAL**
16 Channel • 25 Watt Transceiver • Priority Time-out timer • Off Hook Priority Channel
The *RELM* RH256NB is the updated version of the popular RELM RH256B sixteen-channel VHF land mobile transceiver. The radio technician maintaining your radio system can store up to 16 frequencies without an external programming tool. All radios come with CTCSS tone and scanning capabilities. This transceiver even has a priority function. A 60 Watt VHF 150-162 MHz. version called the **RH606B** is available for $429.95. A UHF 15 watt, 16 channel similar version of this radio called the **LMU15B-A** is also available and covers 450-482 MHz. for only $339.95. An external programming unit **SPM2** for $49.95 is needed for programming the LMU15B.

NEW! RELM® LMV2548B-A

List price $423.33/**CE price $289.95/SPECIAL**
48 Channel • 25 Watt Transceiver • Priority
RELM's new LMV2548B gives you up to 48 channels which can be organized into 4 separate scan areas for convenient grouping of channels and improved communications efficiency. With an external programmer, your radio technician can reprogram this radio in minutes with the **PM100A** programmer for $99.95 without even opening the transciever. A similar 16 channel, 60 watt unit called the **RMV60B** is available for $489.95. A low band version called the **RML60A** for 30-43.000 MHz. or the **RML60B** for 37-50.000 MHz. is also available for $489.95.

RELM® Programming Tools

If you are the dealer or radio technician maintaining your own radio system, you **must** order a programming tool to activate various transceivers. The **PCKIT010** for $149.95 is designed to program almost all RELM radios by interconnecting between a MS/DOS PC and the radio. The **PM100A** for $99.95 is designed to externally program the RMV60B, RML60A, RML60B and LMV2548 radios. The **SPM2** for $49.95 is for the LMV25B and LMU15B transceivers. The **RMP1** for $49.95 is for the RMU45B transceiver. *Programmers must be used with caution and only by qualified personnel because incorrect programming can cause severe interference and disruption to operating communications systems.*

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Bearcat® 200XLT-A

List price $509.95/**CE price $239.95/SPECIAL**
12-Band, 200 Channel • 800 MHz. Handheld Search • Limit • Hold • Priority • Lockout
Frequency range: 29-54, 118-174, 406-512, 806-956 MHz. Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.
The *Bearcat* 200XLT sets a new standard for handheld scanners in performance and dependability. This full featured unit has 200 programmable channels with 10 scanning banks and 12 band coverage. If you want a very similar model without the 800 MHz. band and 100 channels, order the **BC 100XLT-A3** for only $179.95. Includes antenna, carrying case with belt loop, ni-cad battery pack, AC adapter and earphone. Order your scanner now.

Bearcat® 800XLT-A

List price $549.95/**CE price $239.95/SPECIAL**
12-Band, 40 Channel • No-crystal scanner Priority control • Search/Scan • AC/DC
Bands: 29-54, 118-174, 406-512, 806-912 MHz.
Now...nothing excluded in the 806-912 MHz band.
The Uniden 800XLT receives 40 channels in two banks. Scans 15 channels per second. Size 9¼" x 4½" x 12½." If you do not need the 800 MHz. band, a similar model called the **BC 210XLT-A** is available for $178.95.

NEW! Uniden® MR8100-A

List price $849.95/**CE price $486.95**
12-Band, 100 Channel • Surveillance scanner
Bands: 29-54, 116-174, 406-512, 806-956 MHz.
The *Uniden* MR8100 surveillance scanner is different from all other scanners. Originally designed for intelligence agencies, fire departments and public safety use, this scanner offers a breakthrough of new and enhanced features. Scan speed is almost 100 channels per second. You get four digit readout past the decimal point. Complete coverage of 800 MHz. band when programmed with a personal computer. Alphanumeric designation of channels, separate speaker, backlit LCD display and more. To activate the many unique features of the Uniden MR8100 a computer interface program is available for $19.95. Due to manufacturers' territorial restrictions, the MR8100 is not available for *direct* shipment from CEI to CA, OR, WA, NV, ID or UT.

NEW! Ranger® RCI2950-A

List price $549.95/**CE price $249.95/SPECIAL**
10 Meter Mobile Transceiver • Digital VFO Full Band Coverage • All-Mode Operation Backlit liquid crystal display • Repeater Splits RIT • 10 Programmable Memory Positions
Frequency Coverage: 28.0000 MHz. to 29.6999 MHz.
The *Ranger* RCI2950 Mobile 10 Meter Transceiver has everything you need for amateur radio communications. The RF power control feature in the RCI2950 allows you to adjust the RF output power continuously from 1 watt through a full 25 watts output on USB, LSB and CW modes. You get a noise blanker, roger beep, PA mode, mike gain, digital VFO, built-in S/RF/MOD/SWR meter. Frequency selections may be made from a switch on the microphone or the front panel. The RCI2950 gives you AM, FM, USB, LSB or CW operation. For technical info, call Ranger at 619-259-0287.

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Great Ideas From Our Readers

Ending Transmit Chatter

Transmit "chatter" can be quite annoying on both repeaters and links. Most repeaters have a certain "hang time" where the transmitter stays keyed up after the input signal is lost. For home-brewed links and simpler repeaters that don't have these tail-timers, weak signals barely breaking a receiver's squelch can cause an annoying popping, as the link's (or repeater's) transmitter keeps toggling on and off. Here's a simple cure for that problem.

The 14538 monostable multivibrator (here wired in leading-edge trigger, retriggerable mode) gets triggered on the rising edge of the PTT's release. This generates a one-second pulse, during which time the signal will either return, or the circuit will drop out. Through the 4071, either a valid PTT signal or an output from the 14538 must be present to keep a transmitter toggled on. The duty cycle of the 14538 can be calculated by T = RC (T in seconds, R in ohms, C in farads). (See Figure 1a.) Remember to tie all unused inputs of a gate to the proper logic level. (See Figure 1b.)

When releasing the transmitter from transmit mode, the output of the 4071 is positive. Depending on the type of circuitry in your transmitter, this may be unacceptable, or you may wish to use a transistor buffer to protect your IC. If this is the case, I recommend substituting a 14001 for a 14071, as per Figure 1c. (The pinout of the 14071 is identical to the pinout of the 14071.)

Klaus Spies WB9YBM, Niles IL

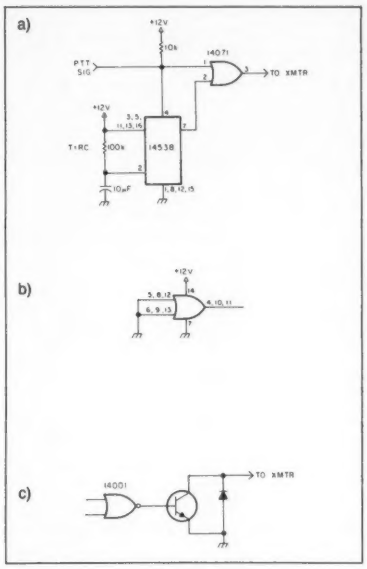


Figure 1.

Adding Digital Output to a Signal Generator

Many experimenters, being on a limited budget, often keep older equipment instead of buying newer equipment with more capability. Because of this, many of them are still using signal generators that do not have digital output capability. Modifying a sine-wave oscillator to give the digital output used in today's modern technology is much easier than most people may think.

Most modern waveform generators provide two digital signals, the second being basically the inverse of the first. The following circuit provides these two outputs, and has one major advantage. While most modern waveform generators provide only one output jack, this circuit, when properly enclosed in its own box, can have two output jacks, one for each signal polarity. The circuit is centered around the MC14093 (CD4093) integrated circuit. This IC is used primarily as a Schmitt trigger. (In this particular IC, the Schmitt trigger is in the form of a NAND gate.) Since the first Schmitt trigger inverts the incoming waveform as a by-product of its operation, another invert function must be provided to have the output signal (labeled "square-wave output") come out at the same phase as the input signal. There are four Schmitt trigger NAND gates available, so there is no problem using a spare gate as an inverter.

Schmitt triggers are used to "square up" noisy square-wave signals, and to take sine waves and convert them to square waves over their hysteresis curve. Note that the input (sine) wave must be symmetrical, and have no DC offset voltage, or the duty cycle of the output square wave will be affected. (This might be desirable in some experiments, but for basic circuits this should not be a major concern.) Reminder: It is always good engineering practice to tie the inputs of unused gates to an appropriate (high or low) logic level.

Let's consider IC output. For driving a typical circuit built by an experimenter, little else is required on the outputs of the 4093, except possibly a 100 ohm resistor between the output of the '93 and the "outside world." This will protect the IC from overcurrent should the output inadvertently be connected to a high voltage, or be shorted to ground. If you expect that the '93 will have to drive several ICs at one time, or if for some other reason you expect a higher load, I strongly recommend that you use a 2N2222A transistor as a buffer/driver.

Another consideration is a housing for the IC. While a single IC can be mounted on almost anything (no critical or special circuit board is required), remember that all power leads should be suitably filtered to ensure pure DC. They should also be bypassed to get rid of any high-frequency noise caused by such things as a high generator frequency, and (for all of those doing work with radios) to bypass any RF from getting into the circuitry. This shielding includes putting the IC into a metal box, and **GROUNDING THE BOX TO THE POWER SUPPLY GROUND**—don't leave it floating!

The 14093, being a CMOS IC, can accept up to 18 volts for supply, with the input signals not to exceed the supply voltage (regardless of which supply voltage you decide to use). This capability can provide another feature for our circuit. A simple switch can toggle in a 5 volt supply to the IC when a 5 volt maximum output is required while experimenting with TTL components. Or, a switch can be toggled to provide 12 volt levels when working on CMOS ICs or other 12 volt circuits (like those found in many mobile radios).

With this circuit, we have now not only brought old (nondigital) signal generators up to modern capability levels, we have also surpassed the capabilities of some of the lower-priced modern generators.

Klaus Spies WB9YBM, Niles IL

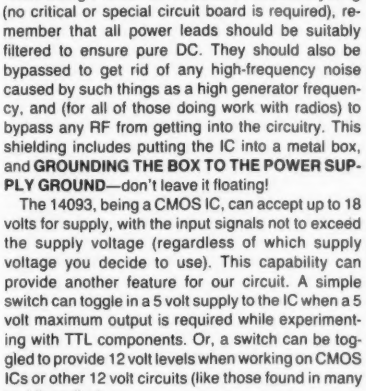
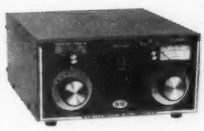


Figure 2.

ANTENNA TUNERS

1500W.



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CIRCLE 53 ON READER SERVICE CARD

73 Review *by David Cassidy N1GPH*

The Kenwood TH-27A

A mini HT with maxi features.

Kenwood U.S.A. Corporation
P.O. Box 22745
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Price Class: $420.

I got my first glimpse of Kenwood's latest entry into the micro-HT arena last September at the Southwest Convention in San Diego. Still awaiting FCC type acceptance, the rig was loaded with a dead battery by the careful Kenwood reps. We couldn't even play with it! Needless to say, this was a tantalizing first look at what has finally come to market as the Kenwood TH-27A.

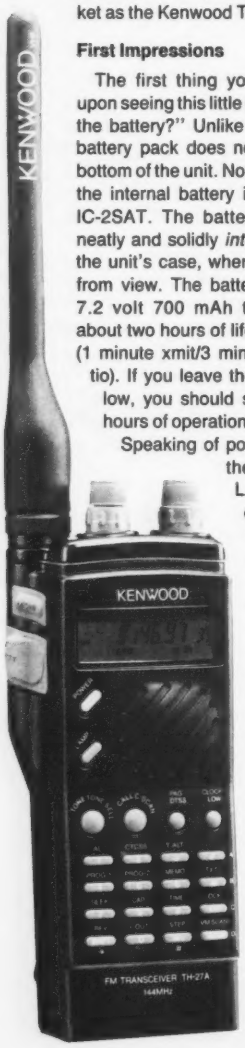

Photo. The Kenwood TH-27A—all curves and full features.

First Impressions

The first thing you ask yourself upon seeing this little rig is, "Where's the battery?" Unlike most HTs, the battery pack does not hang off the bottom of the unit. Nor is it inside, like the internal battery in ICOM's mini IC-2SAT. The battery pack slides neatly and solidly *into* the bottom of the unit's case, where it disappears from view. The battery, a standard 7.2 volt 700 mAh type, provides about two hours of life at high power (1 minute xmit/3 minute receive ratio). If you leave the power set on low, you should see nearly four hours of operation.

Speaking of power, instead of the usual "High/Low" power choice, the TH-27A offers four choices: HIGH, MEDIUM, LOW, and ECONOMIC LOW. The HIGH setting will give you 5 watts with a 12-volt source and 2.5 watts with the 7.2-volt battery. MEDIUM power provides 2 watts, LOW power provides ½ watt, and ECONOMIC LOW gives 20 mW. The manual states that you'll get about 15 hours of battery life if you leave the power on ECONOMIC LOW. I suppose that would be enough juice to get around a fairground or short parade route.

For the past several years HTs have been getting more and more complicated, with more and more features. With the TH-27A, I think we have finally reached the saturation point. This is the first HT that I actually had to read the instruction manual for before operating it. Once you understand the procedures, they're no more difficult than any other modern HT, but the sequences are not readily apparent. Alas, I fear that this will become the norm, as every manufacturer will now want to include all the available features in their products.

The unit is turned on by a front panel button, as opposed to the standard volume control knob. The power button must be depressed for 0.3 seconds for the unit to be activated. I have to say, this seems like something that was designed into the unit for the sake of being different. I can't think of any reason why the standard volume control switch wouldn't be preferable. In fact, although the button is recessed somewhat from the rest of the case, it wouldn't take much for the radio to be turned on by accident. This happened to me when I packed the TH-27A in my suitcase the night before a trip. The only thing that saved me from finding a dead battery was the automatic power-off feature, which turns the radio off after one hour of inactivity.

This little radio feels very solid in your hand. It is obvious that Kenwood has put a lot of thought and design time into the ergonomics of this rig. Every corner and angle is rounded, with no sharp edges. The entire radio is shaped in a very slight "V" angle which fits the curve of your palm and makes the PTT switch fall right under your finger, whether you're a lefty or a righty. The thin and flexible rubber ducky antenna has a covering that comes over the BNC connector and sits flush with the radio housing. This adds much to the sleek appearance of the unit, but it means that there is a definite front and back to the antenna. You can attach it any way you choose, but it is obvious that the antenna and radio were designed to look good a certain way.

The top of the radio holds the volume, squelch and tuning knobs, as well as the speaker, microphone, and DC jacks. All other functions, including the LCD display, are on the front of the rig. This means that there is nothing on the back except the belt clip. This is a trend that I hope continues in HT design. I have always found it downright aggravating to have to hunt for switches or buttons on the back of an HT, especially if you're like me and always keep your HT in a protective case. In addition to the standard 16-button keypad, there are four round buttons which control various functions, as well as the power and lamp buttons. All buttons (except power and lamp) control multiple functions. You won't damage anything by simply experimenting with the different buttons, but this is one radio that forces you to refer to the manual.

The LCD display shows a complete picture of your operating parameters . . . and, I do mean complete! There are 26 separate symbols that inform you of every possible setting. As in most HTs, the display must be read from below or straight on, but even then I found the display a bit on the dark side. The plastic window lies flush with the radio housing. In fact, it is slightly convex. This adds to the physical beauty of the radio but does nothing to protect the window from scratches. Two green LEDs provide illumination. A push of the button will light the display, which will stay lit for five seconds after the last key operation. You can have constant illumination by first pressing the function key.

The speaker audio is surprisingly good for a radio of this size, and the transmit audio is what we've come to expect from Kenwood. Some people prefer transmit audio that boosts the high end, feeling that it increases the communications quality, but I find it tiresome to listen to for any length of time. After all, this is FM. There's no QRM to cut through, and if you're in a noisy environment you're going to have to use an earphone (or hold the radio to your ear) anyway. Kenwood's audio is more evenly balanced and I've always found it easier to listen to.

Frequency Management

Most HTs are placed into either VFO or MEMORY mode by the push of a button. The TH-27A is unique in that MEMORY mode is always available at the push of a single button. It took some time to get used to, but once I became comfortable with the system I found it very convenient.

To access the VFO, you press the ENTER key. This blanks the frequency display and allows you to directly enter a frequency with the numeric keypad. You may now tune the VFO with the tuning knob, or repeat the proce-

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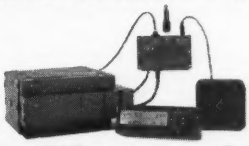

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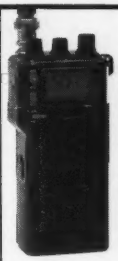

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dure (first hitting the ENTER key) to directly enter another frequency. Hitting a numeric key without first hitting ENTER will immediately choose the memory channel of that number. Once you are in memory, the tuning control will change the memory channels, or you can simply hit another numeric key to access a different memory channel.

This procedure confused me at first, mostly because I was trying to stick to my "never read a manual first" philosophy. A quick read of the appropriate page in the manual made everything clear. For the next few days I would still try to enter a frequency without first hitting that ENTER key, immediately accessing the appropriate memory channel, but in time I became comfortable with the procedure.

You may also return to the VFO from memory by simply hitting the numeric key for the memory channel you are currently in. For example, if you are currently in memory channel 5, touching the 5 key will immediately transfer you back to the VFO. This feature would be very handy for public service or emergency operation, where net control was on a local repeater but on-sight and other communications were on another repeater or simplex frequency. No need to remember what memory channel holds the secondary frequency. Simply put it into the VFO and you can switch instantly between the two.

Thanks for the Memories

There are 40 memory channels and three ways to access them—single number, two number, or tuning knob. With single number entry, you can immediately access memory channels 1–9 by touching the appropriate number key. Channels 11–40 can then be accessed by turning the tuning knob. In two-number entry, all memory channels may be accessed by the number keys, but a 0 must be entered before channels 1–9. Since I travel around the country quite a bit, I found this way of managing memories very convenient. I simply leave the local repeaters in memory channels 1–9 and set the access to single number. When traveling, I enter the new frequencies into the higher memory channels and switch to two-number control. Upon returning home, it's back to one-number access until the next trip.

Memory channel 1 also serves as the priority channel. With the priority alert function on, the radio will sound a tone to let you know when there is activity on that frequency. If you choose, you can set the priority function to immediately switch to the priority frequency, but I think most would opt for the alert tone only.

There is also an independent call channel memory, accessible by a touch of the CALL button. Many hams like to keep their home repeater or local simplex calling frequency in this position. The immediate entry also lends itself to public service work, as mentioned earlier.

Scanning Around

The TH-27A has seven scanning options and three scanning modes. The scanning options are:

Band Scan—which scans over the entire band.
Programmable (PROG-1, PROG-2) Band Scan, 1 and 2—two user-programmable scanning ranges.
MHz Scan—scans over a 1 MHz range.
Memory Scan—scans through all memory channels that have data stored in them and that have not been locked out.
VFO/Memory Scan—alternate scanning of the VFO and the last used memory channel.
Call/VFO Scan—alternate scanning of the VFO and the CALL channel.
Call/Memory Scan—alternate scanning of the CALL channel and the last used memory channel.

In addition to all this, there are three scanning modes. SEEK scan will stop on a busy channel. CARRIER scan will stop on a busy channel, but resume scanning two seconds after the carrier drops. TIME scan stops on a busy channel for five seconds, then resumes scanning even if a signal is still present.

Features, Features and More Features

The TH-27A has the full boat of features we've come to expect in our HTs. Although there is not enough room in a short review to discuss them all (the manual is a full 51 pages), a few of the highlights include:

Tone Squelch/CTCSS. Subaudible tones are programmable and may be used in transmit (to access repeaters) and/or in receive. When used as a tone squelch, your HT remains silent unless the correct tone is present. This is very convenient for monitoring a busy repeater or a simplex frequency at a hamfest. You and your friends decide on a tone to use and you won't have to listen to everyone else's communications. The tone encoder is standard equipment on all TH-27A's sold in the U.S. and Canada. I hope the days of paying extra for this feature are over.

DTMF Memory. Up to 10 telephone numbers of up to 15 digits each may be stored in memory. Call up your repeater's phone patch, push a button, and you're all set. The tones are played through the HT's speaker while being broadcast. It may be totally psychological, but I like to hear the tones (my old Kenwood TH-25 doesn't do this, and it has always bugged me).

Dual Tone Squelch System. This feature keeps your squelch on until the proper three-digit code is heard. This is similar to the tone squelch, except that it's activated by regular tones instead of subaudible tones. This would be handy if any of your friends don't have subaudible tones.

Paging. There is a "Dual Tone Multi Frequency" paging system, the explanation of which takes up six pages in the manual! Basically, it allows you to store your own paging code, and those of other individuals or groups, into memory. This allows you to silently monitor a frequency, until one of the group pages you. The manual doesn't do a very good job at explaining this rather complicated system.

Clock. The TH-27A may be set to display a 24 hour clock.

Timer. In addition to the regular "power off" feature (the transceiver shuts down after 59 minutes of inactivity), you may set a "power on" and "power off" time in conjunction with the 24-hour clock. Just set the time of your local VHF net, and your TH-27A will turn itself on at that time. You can also set it to shut itself off.

Pros

This little rig has a lot going for it. Some of the things I really like are:

Overall design. The TH-27A is a beautiful radio. Kenwood ought to submit it to the Metropolitan Museum.

Overall quality. This is as solid a radio as you're going to find. A lot of the solid feel has to do with the unique battery arrangement. The battery slips up into the transceiver with a nice solid "click." The rubberized knobs and buttons feel very secure.

PTT switch. You may think this is really picking nits, but many of Kenwood's previous HTs had PTT switches that were hard to push. Try spending a day wrestling with the PTT switch on the TH-25, and you'll start to appreciate a smooth and light PTT switch. The PTT switch on the TH-27A is easy to operate, even after several hours.

Included features. The TH-27A has a plug for direct 12-volt input. The subaudible tone encoder is also standard. It's about time these two features became standard on all HTs.

Power settings. The choice of four power settings allows for maximum battery life.

Cons

Nothing in this world is perfect. Some of the things that bugged me about this radio are:

Power switch—it's too easy to turn the radio on or off by accident. The standard volume control switch would have eliminated this problem.

Non-recessed LCD display. It looks great, but I bet every TH-27A we ever see will have scratches across the display window.

One-way antenna. Again, it looks great, but couldn't it have been designed without the front and back sides different?

Manual. The manual for the TH-27A is full of those grammatical errors that at best make for comical reading, and at worst make for confusion and frustration. Kenwood's manuals are generally pretty good, so I don't know what happened with this one. I hope they'll consider rewriting it.

Final Comments

I really think Kenwood has a winner in the TH-27A. The high quality is evident as soon as you hold it in your hand, and the 7.2 volt 700 mAh standard battery is nice to have in such a small HT. The small size makes it easy to pack away for trips, or carry on your belt all day. There's also a 440 MHz version (the TH-47A) for those who need it.

If you're currently shopping for a new HT, I would strongly suggest taking this mini for a test drive. 73

David Cassidy N1GPH is the Associate Publisher of 73 Amateur Radio Today. *You may write to him %* 73.

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massive power supply capable of 2500 watts for half hour!

What makes the Ameritron AL-1200 stand out from other legal limit amplifiers?

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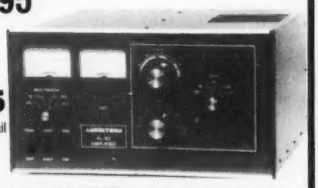

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Future Modulation Amateur Television

Sometimes called frequency modulation.

by Don C. Miller W9NTP

How would you like to forget problems of sync clipping and nonlinear power-limited amplifiers? Amateur television enthusiasts today have the opportunity to free themselves from many of the problems that have plagued them for the last thirty years. Gone is the need for line samplers used to adjust sync, white and blanking levels after the signal has passed through the stages of amplification. The video signal may be improved by 20 to 30 dB over the conventionally transmitted AM television signal. Amateurs reading this article may wonder how they could have missed these great improvements in ATV transmission.

The truth is that amateurs in general did not miss the advantages of frequency modulation (FM) ATV. Only the American hams have missed it. By traveling around the world visiting ATV hams, I have found that FM ATV is used exclusively by European and other foreign ATV enthusiasts. Hams recognized the advantages early on but, since spectrum space was not available on the 70cm band, it wasn't until activity on the 1200 MHz band became popular that it really started to grow in Europe. The lack of available equipment became a problem. If amplitude modulation had been considered, the problems would have been even worse. Semiconductors are notorious for their nonlinearity so the possibility of operating them in Class C mode became the first real advantage of FM ATV in getting some power on the air. In case the reader does not understand the difference between linear amplifiers running at near half power and class C amplifiers running at full power, consider the following.

In amplitude modulation, the modulating waveform is asymmetrical. The video signal is a wide bandwidth signal which is combined with a vertical and horizontal sync signal. The waveform becomes asymmetrical with the sync signal in one direction (maximum power) and the video signal in the opposite direction. The peak power always refers to the power of the sync. In an amplitude system, when nonlinear amplifiers are used the sync signals may be compressed by operating the amplifiers with too much average power output. The Bird wattmeter may read higher when overdriving the amplifier, but a line sampler in the antenna lead will show that the sync pulse has been greatly reduced in height.

With FM ATV, since the sync pulse is modulated in an FM mode, the amplitude of the transmitted signal is constant. The amplifier can be operated at maximum power for as long as the transistors can survive. This is a distinct advantage at UHF, where it is so hard to maintain high power and still have a good waveform. This is the reason that the FM repeaters on two meters and other VHF/UHF bands use voice FM. Single sideband would be more efficient if it were not required to have linear amplifiers, like amplitude modulated television.

Some examples of the use of FM TV are found in commercial and military fields. Today we see satellite dishes in backyards. These antennas are directed toward satellites that broadcast high quality commercial TV. They all use FM for their video transmission. When you see a local TV broadcast station do a remote from a site where action is taking place, they use FM TV. The military use FM TV on all of their television guided missiles. This leads one to believe that there must be something superior for the FM mode over the AM mode.

I feel that amateur radio has existed over the last fifty years only because of its technical contributions. Amateurs experiment and develop new modes and equipment that later show up in commercial use. They also give Third World countries an opportunity to have a free source of electronic and communication technicians that these countries would not be able to afford otherwise. FM ATV affords an opportunity to experiment and build equipment to test out new bands for propagation and other unknown results.

I have always been critical of ATV in America because hams chose to use techniques and circuits that were designed in 1940. Costs were a factor, and equipment discards from commercial usage made it possible to have a lot of fun, but it does not advance the state of the art. A glaring example is the continuous use of the NTSC method of sending color on ATV. If you examine modern methods of sending color you will find that almost any other method is better. When high definition television (HDTV) becomes a reality you will find that a system called Multiple Analog Components (MAC) may be used. This is a system where a single line of TV is divided into two or three parts. Part of the line is the color signal and the other part is luminance, or black and white signal. Slow scanners have been using this method of sending color for 10 years. Why not try it on ATV?

How do you get started in FM ATV? First, you should read the literature. The British

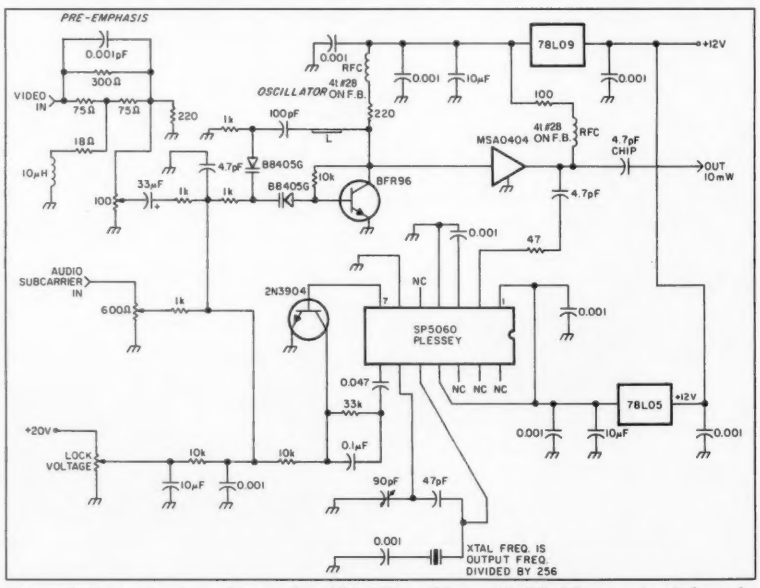
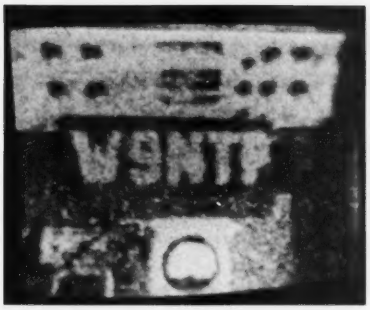
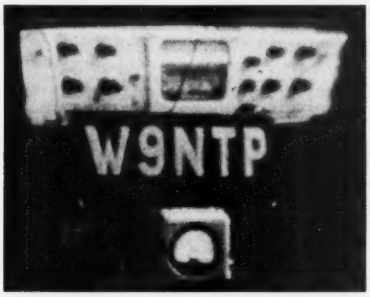


Figure 1. Basic circuit used to produce FM-ATV on 23cm. (Modified from a circuit from the January 89 issue of VHF Communications, p.25).





Photos A & B. Comparison of AM & FM ATV. Top photo is that of a 1 watt 1255 MHz AM ATV transmission over a lossy path. The bottom photo shows the result of using FM modulation over the same path. Note the increased picture quality.

Amateur Television Club magazine is a wealth of information both for circuits and equipment kits. A second magazine called *VHF Communications* from Germany, printed in English, publishes circuits and sells kits for building your own system (kits are available for all circuits). If you are interested in a very good theoretical article on the comparison between AM and FM ATV, I refer you to *VHF Communications*, March, 1986. If you are unable to find this issue, send me a green stamp for a copy.

Since good circuitry for FM ATV is hard to obtain at low cost, many of the first circuits were free-running oscillators that were varied in frequency by a varactor diode modulator. The most popular one that has been produced hundreds of times around the world is called the "Solent." The Worthington group of the BATC still sells this kit. Recently it has been updated by locking it to a crystal oscillator.

Some of the highest quality FM ATV units built today come from a British company called Wood Douglas. Their modules are very well made and are crystal-locked so that you don't have to chase the signal around the band. With FM ATV, signal drift is not serious because of the nature of detection and bandwidth. Wood Douglas makes transmitter modules (10 milliwatts output) and 1200 MHz downconverters which convert to their IF FM ATV board, giving output video and audio. The amateur only needs to connect the output to a computer monitor and he is ready to receive video and audio.

With the British pound increasing even more and the desire of Wood Douglas to discontinue their amateur radio line, Wyman Research developed a new unit which has proven to be superior in design to the original Wood Douglas exciter, and at a much lower price.

A British company called Plessey has developed a chip that is unique to the semiconductor world. This chip is phase-locked-looped and has a divider chain that inputs a 1200 MHz signal at a rather low level, divides it by 256 and locks it to a crystal in the 4 MHz range. The loop is adjusted by varying the voltage on a varactor diode to bring the free-running oscillator into range. Once the loop is locked to the crystal, video and audio subcarriers can be added to the loop control voltage to vary the frequency to produce FM ATV which is locked to the carrier frequency. The circuit is extremely easy to get going and is the basis of most of the FM ATV systems around the world. Included in the circuitry is a preemphasis circuit, standard to all FM ATV, which increases the deviation at high video frequencies. This is later compensated for by using deemphasis at the receiver to restore the proper levels (see Figure 1). *[Ed. Note: A PC board or kit is available for this transmitter. See address at end of the article.]*

A word about FM ATV receivers: Those of you who are flea market buyers may want to try discarded satellite receivers. Caution is in order. Satellite receivers are designed for larger bandwidths and deviation than is used on amateur FM ATV. The result is that there is increased noise in the received signal because of the added noise in the unused passband, and the level of the video is much less than normal because of the lack of full discriminator detection. A real experimenter should be able to decrease the bandwidth and add a stage of video gain to make them usable. Don't judge the results of FM ATV by using a satellite receiver. A receiver designed specifically for FM ATV will do remarkably better.

Note that I've said nothing about using a TV set in an FM ATV system. After all, we have been talking about Future Modulation (FM) not Ancient Modulation (AM). If you insist, however, an ordinary TV set can detect an FM ATV signal poorly by using the principle of slope detection.

Those of you who have trouble building AM video transmitters should have no trouble building FM video transmitters. After all, most of the complicated circuitry has been eliminated.

I would enjoy receiving comments in regard to FM ATV. The cost per watt for FM ATV is now lower than AM ATV. Considering the fact that no expensive test equipment is required to build the gear or align it makes it a very good mode from an economic viewpoint. 73

Subscriptions to the BATC as well as a line of FM ATV equipment are available from Don C. Miller W9NTP at Wyman Research, Box 95 RR 1, Waldron IN 46182. Phone: (317) 525-6452.

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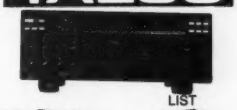
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Take A West Indies DXpedition?

"No Problem, Mon!"

by "Dee" Logan VP2E/W1HEO

Can three Ohio couples combine a vacation and DXpedition to the West Indies, rack up 4,273 QSOs in five days, plus avoid serious sunburns? As they say on Anguilla, "No problem, mon!"

The idea for our DXpedition to Anguilla originated with several members of the Lake County (Ohio) Amateur Radio Association. All shared the fantasy of someday finding themselves in a rare DX location, being pursued by the multitudes and working the pileups. As exciting as that idea was, we broadened its appeal by combining it with a family vacation.

Our casual talk turned serious when several club members and their spouses began meeting over potluck dinners to plan the real thing. First, what was our criteria? We decided on a somewhat rare DX country that had reciprocal licensing with the United States, was in a warm vacation spot served by commercial airlines, and had affordable lodging that allowed ham radio operations.

Selecting the Location

Each of us agreed to research one or two possible spots. For several weeks we collected information, with the Caribbean a favorite area. Our short list included Montserrat, the Bahamas, Virgin Islands, Anguilla, and the Turks and Caicos.

After completing our individual research, we reassembled to make our selection. There were several attractive possibilities. Some hams rent Caribbean vacation retreats that are completely equipped with ham radio stations. However, we felt that since these were widely advertised, they would tend to be well-occupied and thus less rare.

Anguilla was especially interesting to me. If you want good information on a DX country, ask someone who lives there. I ran across VP2EHF on 20 meters one day and quickly plunged into a detailed discussion with Dave about Anguilla. He said that there really weren't many hams on his island—perhaps six. This was good news. It sounded to me like a somewhat under-represented country on the air and thus a good candidate.

Anguilla, I learned, is the northernmost of the British Leeward Islands. It lies some 150 miles east of Puerto Rico, just seven miles from St. Martin. A small island, it's only 16 miles long and three miles wide. Its long, serpentine shape was noted by Columbus, who sailed by in 1493 and dubbed it Anguilla, the Italian word for eel.

Unlike some Caribbean islands that offer exotic scenery such as mountains or rain forests, Anguilla is rather plain. The 35-square-mile country is flat, rising only 213 feet above sea level. It's also dry. There are no streams, rivers or waterfalls, and most of

Photo A. The VP2EOH DXpedition's main operating location—a seaside villa on Anguilla. Note the 15-foot tower and tribander on the roof. The flat roof made antenna installation easy.

Photo B. The tower for VP2EOH was borrowed from an Anguilla ham, and the tribander was donated to the island's Boy Scouts afterwards.

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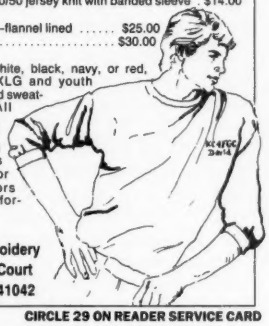

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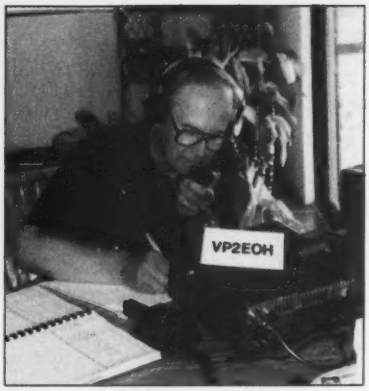

Photo C. VP2EOH, operated by Dee, W1HEO, on Anguilla during April 1990.

Photo D. On a beach on Sea Feathers Bay, across from the operating site, VP2EOH expresses satisfaction with the DXpedition results.

the vegetation is low-lying grasses and cactus.

For seekers of glitter and nightlife, Anguilla is definitely not Las Vegas. It is quiet, calm, and has no cities at all. While there are a few exotic, pricey resorts on the island, for the most part Anguilla is residential, with a few shops and markets scattered here and there.

So why visit the place? The answer is found on its sparkling white beaches. There are 30 of them, along with colorful coral stretches offering some of the world's best scuba diving and snorkeling.

For a ham, the island is ideal. No mountains block your signal. Easy licensing: Show your U.S. ticket and pay a $38 U.S. fee. Electrical supply is 115 volts, 60 Hz alternating current. Nights are quiet, with little manmade interference.

Additional details on VP2E came in a comprehensive DXer's guide published by the Anguilla Amateur Radio Association. (Available from P.O. Box DX, The Valley, Anguilla B.W.I.) Anyone planning a DXpedition there should write for this handy reference.

We selected Anguilla on its many merits. Certainly one of them was that it was an undeveloped island that wasn't overrun with either tourists or hams.

Getting Ready

A remaining task was finding a place to stay. Our prime requirement was a hotel or villa that welcomed hams. Several candidates were identified by Scott KO8O. The off-season rates began in mid-April, and we found some neat villas available then on the south side of the island at Sea Feathers Bay. And they welcomed hams!

Now for the deposits and reservations. Which of the group would go? Three couples decided to make the trip: Bob K8BL and his XYL Marcia; Scott KO8O and wife Jo; and myself, "Dee" W1HEO, and spouse Liz. We all dug deeply into our credit cards and took the plunge.

In the months leading up to our trip we pulled together the radio gear. We all agreed that to assure a good signal we'd run a yagi. Fortunately, we found a small triband beam at a sale price. It was assembled, checked out for low SWR, and then shipped to Anguilla well ahead of our departure date. (We donated the beam to the Anguilla Boy Scouts after our DXpedition.) We also carried along a 40-meter inverted vee, but opted not to operate on 75 meters, figuring there would be enough activity on 10–40 meters. We were right! We took an ICOM 735 transceiver and borrowed a power supply from a VP2E ham. We decided against bringing an amplifier. It would be too heavy, and we doubted that we'd need it. Right again!

On a cold, snowy morning on April 18, 1990, we began our trip. A great day to fly south to the sun! Our flight took us to San Juan, Puerto Rico, with several hours between planes for sightseeing. We headed for old San Juan, with one of our main stops the El Morro Castle, a large fortress rising 140 feet above the sea. After some shopping and a bite, we left on the last leg of our flight, arriving in Anguilla after dark. It had been a long day.

We awakened to our first day on Anguilla with a glowing sun and sparkling cobalt waters of the Caribbean outside our villas. That's what we came for. Another was the ham license. We headed for the offices of Radio Anguilla and presented ourselves to the official in charge, Nat Hodge. He wrote our simple, one-page licenses, collected $38 U.S., and also issued us a special callsign, VP2EOH. Since we qualified by operating in a contest—the North American QSO Party—we picked EOH for Eastern Ohio Hams.

Setting Up and Getting On

Getting the station together was next. We had borrowed a 15-foot aluminum tower to support our tribander, but discovered to our surprise that it was still in the box! So, around 1:00 p.m. we began the complex assembly job. We worked in what little shade we could find, since the sun was high and so was the humidity. Even natives complained about the heat. The tower was a problem. It didn't go together right. We tore it apart. We rebuilt it. Three times! Finally, we settled for a reasonable approximation of its intended design, ignoring the parts left over.

Since the villas we rented had flat roofs, it was easy to erect the tower and beam and hang the inverted vee from the top, dropping the ends off each side of the villa. Then came a problem. As we checked out the rotor and plugged in the transceiver, the rig died! While it worked in the FM mode, it was going nowhere on SSB. Bob K8BL tore the unit apart, searching for a clue. Murphy had struck again!

After puzzling over the rig for some time, Bob grabbed his voltmeter and checked some things. Bingo! The coax feedline to the antenna showed 70 volts AC. No wonder the rig was tripping out. We unplugged the rotor control and the stray voltage disappeared. While we had no idea why the problem existed, we decided to simply leave the rotor unplugged and apply power only with the rig off the air. At last we were ready to send our brand new VP2EOH call letters to waiting DXers!

We began by checking 10 meters. We were in luck! The band was hopping, with signals pouring in from stateside. Our first call

VP2EOH

1990 DXPEDITION BY BOB (K8BL), SCOTT (KO8O), DEE (W1HEO)
LAKE COUNTY ARA (OHIO)

RADIO	DATE	UTC	BAND	2 X	REPORT
	April 19 20 21 22 23 24		10 15 20 40	SSB CW	

73 TNX QSL K8BL, MGR. VERIFIED BY:

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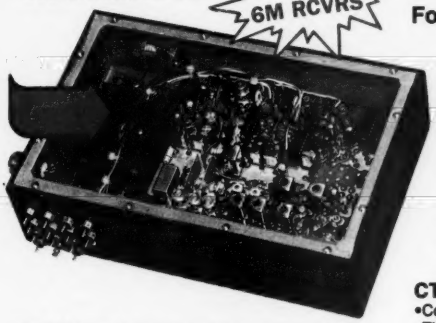

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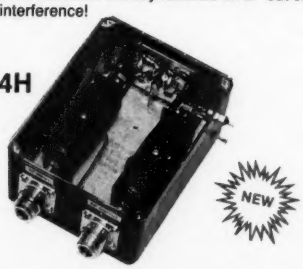
FL-4H



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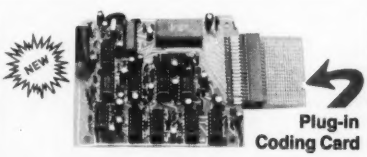

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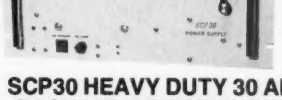

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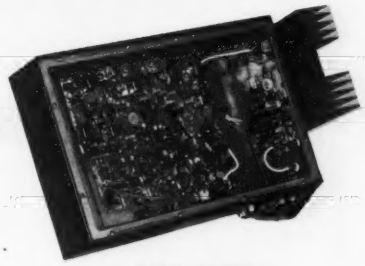
- 30A @ 70% duty, 25A @ 100% duty.
- Massive 30 lb. Transformer & Heat Sinks.



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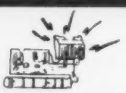

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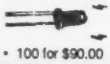

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brought an instant response from one of our fellow radio club members, Mark KB8FKM, who had obviously been camped out on frequency waiting for us to show up. Signal reports were good, so obviously we were doing well with our 100 watts. The salt water assist was dramatically evident.

And the pile-ups! While we realized that VP2E was somewhat in demand, we didn't realize what the sound of that demand would be at our end. It sounded like buzzing bees, with no calls heard. We quickly decided that if we were to achieve an efficient rate of contacts, we would have to maintain discipline on frequency and use a system to pick out the calls.

Our system was to go by call areas whenever the pile-ups got bad and, when necessary, to make up short lists based upon the last two letters of a call. We tried to give our QSL route, location, name and other info about every five minutes or so. We also thanked people for being patient while we worked as fast as we could. In fact, most operators—especially the stateside DXers—are to be congratulated for their on-the-air discipline.

For five days we kept VP2EOH on the air about 18 hours daily. We alternated operating, eventually settling on a two-hours-on, four-hours-off cycle. Two hours of intense operating in the tropical heat was about the right span. After that, it was time to hit the beach or go sightseeing.

While checking out the island in our rental car, we drove carefully on the left side of the road, stopping at shops, restaurants, craft galleries and various beaches. Snorkeling and scuba diving were excellent. Our villas provided us with a great view of St. Martin nearby, so we naturally took the 20-minute ferry ride over for a look. French restaurants abound, so we sampled some of the cuisine at lunch. It was outstanding! Later, we discovered the 2 meter repeater on the island and used it to contact locals VP2EOH and VP2EE.

Our experience with big pile-ups showed the value of asking for just the last two letters of a call. Doing this cut down the size of the pile by 60%. After making contact, the first thing someone working a DX station should do is *transmit their call* and make sure it's copied correctly by the DX station. Also, don't waste time during a contact asking for routine info such as QSL routes. These items are usually given about every five minutes or so, as we did.

Despite the time out for sightseeing, we worked 4,273 stations in the five days we were on the air. Our log showed 87 countries, 50 states, and all continents. About 57% of our contacts were stateside, with 81% on SSB and 19% on CW. The lion's share of QSOs were on 10 meters (2,838), followed by 15 and 20 meters with 686 each. We averaged slightly over one contact per minute. Conditions were very good, with openings to North America and Europe well into the evening hours.

Planning Your Own DXpedition

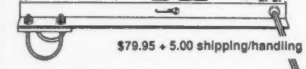
We hope you worked VP2EOH. And we invite you to plan *your* DXpedition. It's great fun, and doesn't cost much more than a regular vacation to the same spot. *Being* DX is a great experience. Take it from one who's done it, it's the vacation of a lifetime! Many details must be covered in advance, of course, so plan early to insure a smooth DX operation.

We learned a few other things in the process that may interest DXers.

First, *time your calls*. During big pile-ups, it's tough to pick out calls, so wait a few seconds before transmitting your call. We found that often the tail-ender was the only one we copied.

Next, *listen to the DXer's pattern*. Is each contact just call and report? Or is the DXer collecting QTHs and names? Note what's going on before transmitting. Full calls or last two letters? 73

AAIA SIDEKICK ANTENNAS



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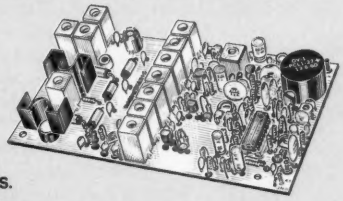
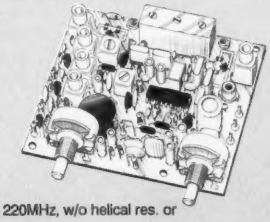


FM EXCITERS: kits $99, w/t $169. 2W continuous duty. TCXO & xtal oven options available. *FCC type accepted for com'l uhf & hi bands.*

- **TA51** for 2M, 150-174, 220MHz.
- **TA451** for uhf.
- **TA901** for 902-928MHz, (0.5W out; w/t only).
- **VHF & UHF AMPLIFIERS.** For fm, ssb, atv. Output from 10W to 100W. Several models, kits starting at $79.



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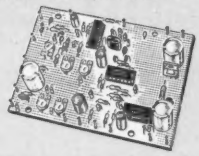
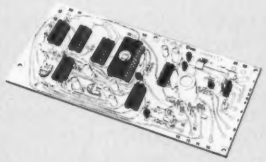
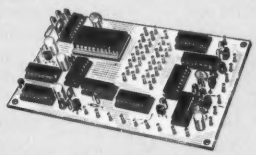


COR-3 REPEATER CONTROLLER kit. Features adjustable tail & time-out timers, solid-state relay, courtesy beep, and local speaker amplifier $49

CWID kit. Diode programmed any time in the field, adjustable tone, speed, and timer, to go with COR-3 .....$59



COR-4 kit. Complete COR and CWID all on one board for easy construction. CMOS logic for low power consumption. Many new features. EPROM programmed; specify call $99



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LNW-(*)

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LNS-(*)

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CIRCLE 57 ON READER SERVICE CARD

73 Review

by Peter H. Putman KT2B

SHF Systems Linear Transverters for 1240 and 2304 MHz

Explore the microwave bands with these easy-to-build kits.

Down East Microwave
Box 2310, RR1
Troy ME 04987
(207) 948–3741
Price Class: $140–$310

One of the biggest obstacles to increasing the amateur population on our microwave bands has been, and continues to be, the lack of ready-made equipment at reasonable prices. Several manufacturers have offered a line of linear transmit and receive converters (known as transverters) that are ready to run out of the box, but at prices that may discourage newcomers.

For those with the technical know-how, the best method has been to "roll your own" equipment, either completely from scratch or from a kit. If you have access to microwave test equipment, this process isn't all that difficult. For those who don't, and who possess only a basic knowledge of microwave operation, it can be an uphill battle all the way with all of the precise assembly and alignment involved!

Things have changed considerably with the advent of microwave monolithic integrated circuits (MMICs) over the past few years. These devices offer broadbanded, no-tune performance with reasonable gain and noise figures at affordable prices. MMICs can be used both as low-power RF gain stages and as RF amplifiers on receive, and they are reasonably stable in operation.

SHF Systems has introduced a line of linear transverters which make extensive use of these devices, along with etched microstrip circuitry. As a result, even the basic kit builder can be up and running on several microwave bands with a minimum of test equipment and time. *[Ed. Note: Down East Microwave is the sole distributor of the SHF Systems kits.]*

The SHF Transverters

Currently, SHF Systems offers transverters for 902 MHz, 1296 MHz, 2304 MHz, and 3456 MHz. In each case, the complete transverter consists of a local oscillator (LO), transmit upconverter, and receive downconverter. All three are located on one PC board on the 902 MHz version. The other three use a separate LO board. Our review versions (SHF-1240 and SHF-2304) are very similar in operation and appearance, although the SHF-2304 transverter board is smaller in size. Both use the same LO circuit, with different crystal frequencies, and both systems use an intermediate frequency (IF) of 144 MHz, making them a natural for use with 2 meter multimode equipment, and even 2 meter FM transceivers.

The key to a stable microwave signal is a stable local oscillator. The SHF-LO employs a 2-stage circuit of BFX89 devices, functioning as a crystal oscillator and buffer amplifier. A series of MMICs and one HP2835 diode multiply the signal into the 540–580 MHz range. Two 3-stage bandpass filters and one low-pass filter ensure a clean signal at the output. An option allows the user 4 dBm more gain (required for the 2304 input).

For 1296 operation, the LO signal is doubled by another HP2835 diode into two more MMICs and associated filters, resulting in an LO injection frequency of 1152 MHz. Both 144 MHz IF ports are coupled to a pair of Wilkenson splitters in a "rat race" mixer scheme. At 2304 MHz, operation is similar except that the 4th harmonic of the LO is selected (2160 MHz) and filtered before injection into the Wilkenson splitter.

Actual TX and RX mixing is performed by a pair of HP2835 diodes on the SHF 1240, while a tiny diode pack of HP-HSMS2822 diodes do the trick at 2304. In either case, there are no tuning adjustments to be made, only some careful soldering when installing these diodes. These mixers are quite sensitive, as only 1 mW of energy at 144 MHz is required for drive.

Both boards are completely symmetrical. This means that either side of the board can be used as a receive or transmit converter, or that both sides could be used for the same purpose. As in the LO, no tuning adjustments are necessary. Depending on the model, different MMICs are used as TX and RX gain stages with 3-pole bandpass filters between the cascaded gain stages.

Although the noise figure performance of the MMICs used is quite good, a GaAsFET preamplifier on the RX side will yield noticeable improvement. Typical power output on both boards is in the range of 10 mW, but higher outputs can be obtained with more drive and LO injection. The RX conversion gain is typically 20–25 dB, more than enough to drive the front end of a 2 meter multimode transceiver.

Construction

The manual for the SHF LO states that it can be built in under two hours. I took just about two hours to be extra careful, since the case lead identification on the various MMICs can be confusing. For the record, large case MMICS (such as MSA-0404 types) have a dot on the OUTPUT lead, and smaller MMICs (such as the MSA-0685) have it on the INPUT lead. Most cases of trouble with these kits are a result of incorrect lead positioning.

You won't need much test equipment to

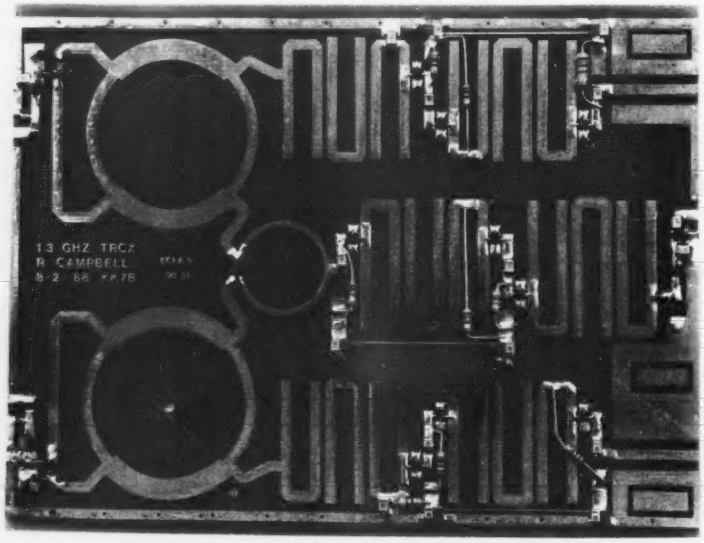

Photo A. The SHF-1240 transverter board (1296 MHz).

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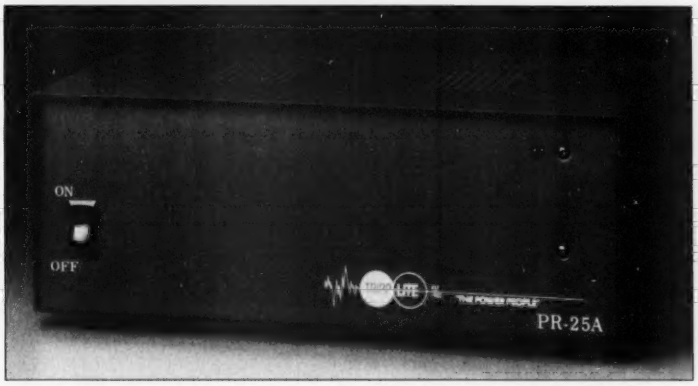

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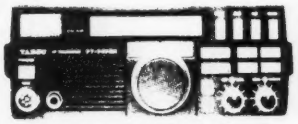

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check the LO. A simple VOM will do, as you peak the crystal trimmer for current. This will typically be in the range of 200 mA, and a distinct peak will be observed. A 600 MHz or higher frequency counter is handy to verify the actual output frequency while you make this adjustment. An RF millivoltmeter can be used to measure actual LO levels, or a diode probe and FETVOM will suffice for relative output.

The transverter boards present varying levels of difficulty. The SHF 1240 version is assembled on G10 epoxy board and can be done in about one hour. The SHF 2304 uses Rogers Duroid material, and all of the grounding holes for each MMIC must be soldered from the top to the bottom ground plane, using copper foil supplied in the kit. This adds about 30 minutes to an hour to the job.

MMIC installation is simple. I suggest cutting the leads prior to soldering, and watch those case dots! Once the MMICs are soldered in, they are very difficult to remove without destroying them. Fortunately, they are also relatively inexpensive ($2–$6, depending on the model), so you won't break the bank if you goof up.

Testing the transverter boards may require nothing more than a sensitive frequency counter on transmit, and another 2304 MHz signal source on receive. Since there's no tuning to be done, the units will either work fine or they won't work at all when powered up! The input power level of 1 mW may be problematic, so the distributor (Down East Microwave) offers a PIN-diode IF switch and attenuator kit as an accessory. This kit can handle up to 3 watts of 144 MHz energy, depending on the resistors installed.

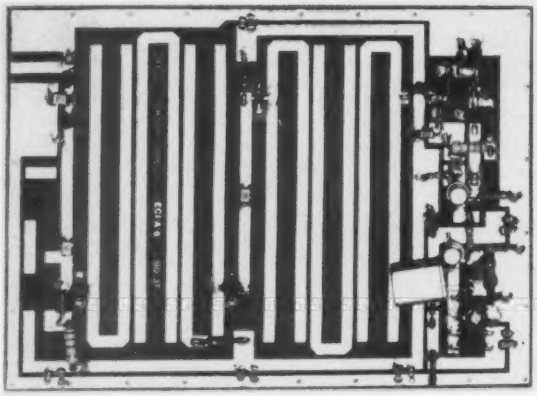


Photo B. The SHF-LO board.

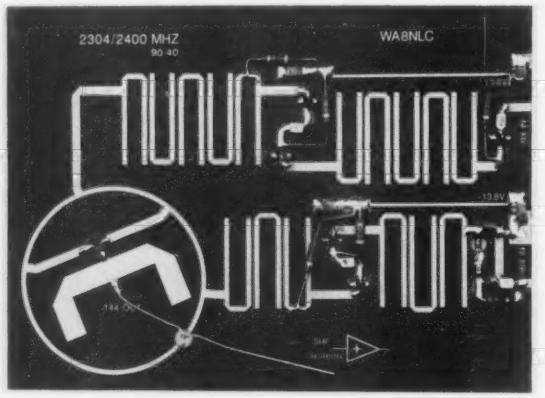


Photo C. SHF 2401K receive converter (for mode S receive).

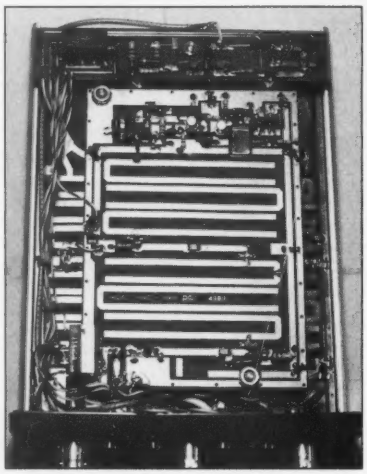


Photo D. The SHF 1240 complete transverter.

Performance

Both transverters have worked very well here and in portable operations. I soldered the LO to the back of the SHF 1240 board and installed the combination in a Radio Shack metal housing (CAT# 270-272), using BNC connectors for 1296 RX and TX connections as well as 144 MHz In/Out. This chassis also accommodates the PIN diode board. The addition of a Down East 1296 preamplifier and RF power module completes the station, giving me 6 watts output in a small package.

The 2304 MHz station was installed in an enclosure sold by Down East Microwave. Again, the LO was soldered to the back of the transverter board. Since this combination is much smaller, I was able to fit it and the PIN diode board into this enclosure. SMA connectors were used at the 2304 RX and TX connections, with a BNC at 144 MHz. Down East sells an inexpensive 2304 GaAsFET preamplifier kit using an Avantek ATF10135 device which was also added. A pair of Frontier Microwave gain stages brought the output up to 2 watts.

I've used the 1296 station twice from mountaintops and it has been extremely reliable over a range of battery voltages, working down into the 11.5 volt level without difficulty. Although the PIN diode board offers a MMIC IF post-amplifier stage as an option, I found it to be unnecessary when used with a Yaesu FT-290RII transceiver. Due to tolerances in the LO crystal used, however, my actual 1296 frequency was off by about −8 kHz from what was displayed.

On 2304, the displayed frequency was much closer, reading low by 5 kHz. Since the 2 watt gain block needs 24 VDC, I use a dual power supply system in the base station. A surplus Microwave Associates 24 VDC SMA relay is also powered by this system. When portable, I use only the first gain stage which needs 12 VDC and develops about 300 mW output, more than enough power when mountaintopping with a 45 element loop yagi.

Other Observations

I can honestly say that these are the easiest microwave kits I've ever assembled. They both worked right off the bat, although the 2304 MHz unit exhibited some instability in the MSA0885 TX output stage. This is due to a downgrading by Avantek of this device from "unconditionally stable" to "conditionally stable" at this frequency. Repositioning a resistor lead to function as a choke cured the problem.

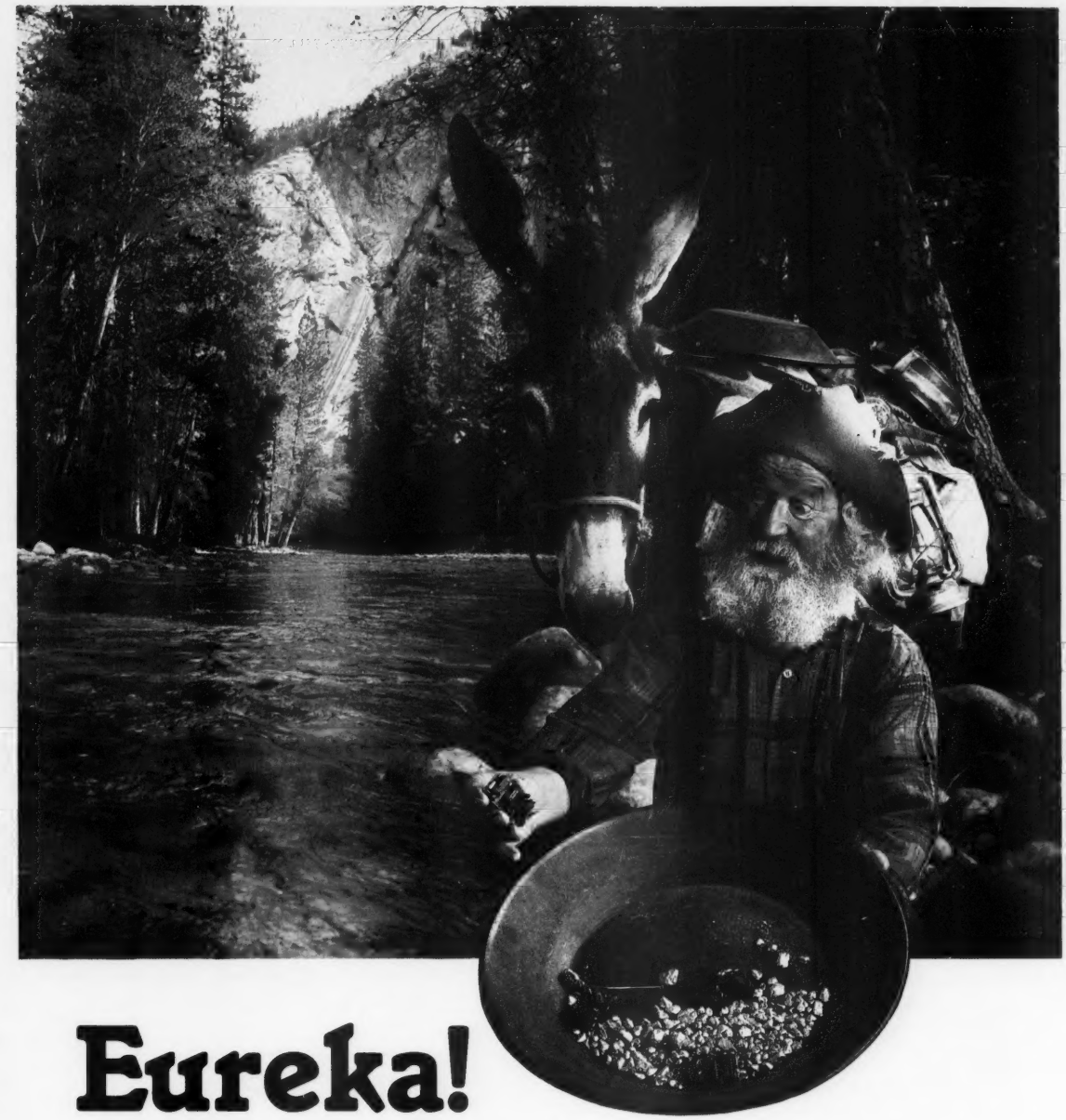
As with any microwave equipment, you'll be working with some very small components, especially the chip capacitors and diode packs. I suggest using a well-lit work area and placing sheets of white typewriter paper under the components to locate them quickly. Doubling over a strip of masking tape on paper and sticking the parts to it until needed works very well.

The documentation for these kits is constantly being upgraded. For 1296, it rates a B+, and is suitable for the builder with basic kit-building experience. Having a knowledgeable ham friend is a plus. For 2304, I give the documentation a C− as it had several errors on a hand-drawn pictorial diagram and showed two resistors connected to the wrong leads on MMICs. Unlike the 1296 kit, no schematics are shown.

Bill Olson of Down East Microwave has made every effort to ensure that buyers of these kits get the correct information when questions do arise—even to the extent of shipping some extra parts gratis, so "factory support" rates an A+. Thanks, Bill!

To summarize, both kits represent a low-cost, low-risk way to become active on microwave frequencies. And you'll have the added benefit of learning a few things about microstrip and surface-mount construction techniques along the way.

The SHF-1240 complete kit, including TX/RX converter and LO board, is priced at $139; the assembled board is $179; the transverter in an enclosure with a PIN diode IF switch is $225. The SHF-2304 complete kit, including TX/RX converter and LO board, is $195; the assembled board $235; complete transverter in an enclosure with a PIN diode IF switch is $310. 73



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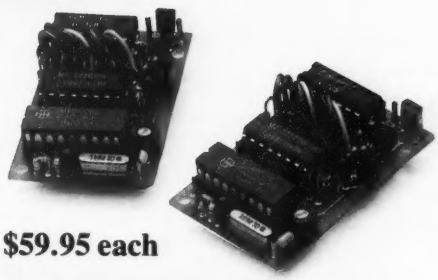

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Lights, Camera, ATV

One of the fun things about being an instructor of an amateur radio class is that you can never run out of exciting and informative demonstrations to bring into the classroom. The "sparkle" component (see the October 1990 "Hams with Class") of your program is what will have your students remembering the course years after they've completed it.

Since many youngsters today are overstimulated and underworked, they've got to be approached with something of obvious benefit to them right off the bat. Remember always that the way the instructor presents the topic is of critical importance. Children are the best at reacting to a teacher's sense of excitement. If you are genuinely enthusiastic about your presentation, you'll have them at complete attention, anticipating something special. Don't disappoint them. Hit them right up front with what's in it for them.

Photo A. John, Dan, and Mike setting up the van with ATV equipment for the demo at I.S. #72 in Staten Island, New York.

Recently, I set the stage for a demonstration of amateur TV at my school. The children in my 6th, 7th, and 8th grade ham radio classes have often heard members of the Bayonne Emergency Management Amateur Radio Club on the air discussing ATV. They were looking forward to the morning when my fellow club members would be arriving to set up an ATV demonstration in our school auditorium.

Plenty of Participation

Filled with anticipation, my students quickly spread the word to their other schoolmates and teachers. Before I knew it, I had several requests from other staff members to bring their classes to the auditorium to see the demonstration. Of course, I arranged for the additional seating and enjoyed the idea of non-ham students being exposed to amateur radio in a fun way.

When the big day came, we weren't disappointed. John WA2QYX, Mike KB2EQQ, Danny N2EHN, Lee WA2JWR, and 12-year-old Walter KB2IOZ provided us with an outstanding experience. John, Mike, and Danny interacted with the children in a thoroughly professional and well-coordinated manner. Their own obvious enjoyment and expertise with this media came through loud and clear. Even passersby on the street were impressed with the way the event was being handled. Lee and Walter worked behind the scenes to make sure everything went smoothly.

The children not only learned about how enjoyable ATV can be, but also about how terrific it is that hams can rely on each other for help, resources, and fun.

John and Mike KB2GVJ, his son, submitted the following write-up to me. Mike is 14 years-old, and he has been a ham for two years. He loves going along with his dad and the others whenever he can to help demonstrate ATV.

John Anzivino WA2QYX's Report

A television appearance can bring out the "ham" in all of us. Imagine what fun it was to let a group of 6th, 7th, and 8th grade students get into the action. On October 15 several members of the Bayonne Emergency Management Amateur Radio Club, BEMARC, demonstrated the ATV mode of amateur radio to the students of Staten Island Intermediate School #72. Six club members participated in the live TV demo, complete with a fully equipped mobile van and a small downconverter connected to a large-screen TV set in the school auditorium.

Preparation began early in the morning, when John WA2QYX, Mike KB2EQQ, and Danny N2EHN met for coffee near the school. The other two club participants, Lee WA2JWR and his 12-year-old son, Walter KB2IOZ, met them at the school at 8 a.m. The camera equipment, a basic camcorder, was set on a tripod in front of the school. The antenna was a simple 440 MHz vertical. The output of the camcorder was fed into a small 10-watt ATV transmitter, and we were ready to go! A mobile 440 MHz vertical antenna was connected to the downconverter inside the school auditorium, and the output was displayed on the school's large-screen TV set.

Photo B. Mike KB2EQQ stands at the back of the class to watch the ATV demonstration from the viewpoint of the kids.

As the students watched live TV pictures transmitted via amateur radio, the club members explained how easy it is to have fun with your own TV station. Imagine sharing live television pictures all summer long with your friends all over town; doing homework together on two-way television; sharing videotapes of your vacation; showing each other your gifts during the holiday vacation; or putting your parents, brothers, sisters, and the family pet on your own TV show!

During the demonstration, several people walking by on the street were put on television. Most stopped to say hello to the students, and all were impressed with the idea of personal television. The next step was to put some teachers on the screen. We asked one teacher, who teaches a drama class, to come outside and become a star on amateur television. She saw an immediate advantage in ATV for her students. Perhaps we have another prospective ham at I.S. #72.

Finally, we took several students outside and made them ATV stars. The creativity of the students came out in full force. A group of three students said hello to their classmates and told us what they would do with their own amateur TV station. Among the second group of student ATV stars was a budding comic who made the auditorium laugh with his antics and funny faces. When the bell rang, signaling the end of the class period, many students were disappointed; they wanted more ATV action. After the demonstration, many students asked for information on how to get their own amateur radio license. Their teachers explained the school program, and the members of BEMARC promised to return for another television event.

When the BEMARC mobile TV crew arrives at a club meeting site, we usually park the van in a nearby parking lot or other interesting location. If possible, we park on a busy local street and capture people shopping and the colorful scenes in the small store windows. Mike KB2EQQ sets up inside the club.

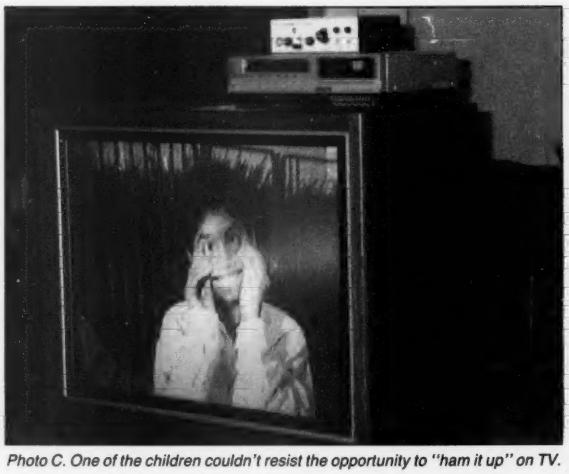

Photo C. One of the children couldn't resist the opportunity to "ham it up" on TV.

He shows all the equipment used for ATV, and removes the covers on the units to explain the function of each board.

We use HTs on simplex for audio between the mobile van and the club meeting room. This way, any club member who has a question for the outside crew can see the mobile member answering over the TV. Full duplex is possible in that manner.

The demonstration starts with the video tape transmitted from the camcorder in the mobile van. Next we switch to live action and show all the outdoor scenes in the area. Before we complete our demonstration, we usually ask some of the club members to come outside and we transmit their picture back to the club.

Since December 1989, our club has completed 14 demonstrations. We've received many comments about our ATV activity, and several more hams have purchased ATV equipment in our area.

If your club is located in the New York City/Northern New Jersey area, and you would like the BEMARC ATV road show, contact our club president, Mike KB2EQQ.

A Coming Attraction

Any instructor who is searching for an innovative and exciting demonstration for the classroom should consider an ATV event. Most schools and clubs today have access to standard video equipment. A basic ATV station consists simply of an ATV transceiver, an antenna, a TV camcorder, a monitor, and a VCR. If you don't have the equipment yourself right now, you can make your desire for a presentation be known to your local radio clubs. Some ham will know of another ham who is involved in ATV. You'll probably be delighted with the response you get. I know you'll be delighted with the reaction you'll get from your audience of students. Amateur TV is a fun way to motivate prospective hams and to capture people's attention.

As a result of the wonderful presentation at our school, five more students had their programs changed so that they could be in the ham radio class. I certainly became convinced of the value of adding ATV to my curriculum. Only a few weeks after the initial ATV demo, our school is well on its way to having its own TV station. Thanks to the generosity of AEA and Mike Lamb, and the help of local hams, we expect to be on the air, seen as well as heard, very soon.

Give it a try and let me know what results you get. 73

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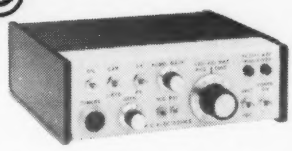

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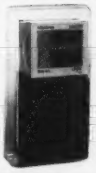

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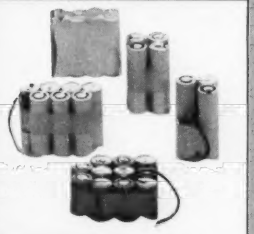

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Pour an Antenna for X-Band

20–20 vision for your microwave system!

by John M. Franke WA4WDL

Ever heard of anyone pouring an antenna? This idea isn't as silly as it sounds, and it's quite easy.

What I am referring to is casting lenses—microwave lenses. It turns out that optical lenses above 3 GHz actually help correct aberrations in the wavefront coming out of a horn antenna, thereby reducing sidelobes. A lens collects and collimates the energy coming out of the horn which results in an increase in gain.

Some time ago, Bill Hoisington K1CLL described a simple X-band (10 GHz) crystal set using a 1N23 detector and a hemisphere of wax as the antenna. (See "The World of X-Band" by Bill Hoisington K1CLL, *73*, March 1975.) He cast ordinary kitchen paraffin to make several short focal length lenses about 0.64cm and 12.7cm in diameter. Paraffin is not optically transparent, but microwaves do not know that. The wax is very clear to microwave energy. Also, the lens surface does not have to be optically smooth. As long as the imperfections are less than an eighth wavelength (0.142 inches), there should not be any noticeable effects. Lenses are much more tolerant of surface errors than are reflector or "dish" antennas. A surface error on a reflector is doubled upon reflection. For example, a tenth-wave bump or dent produces a fifth-wave distortion in the wavefront. A microwave lens with an index of refraction of 1.5 and having a tenth-wave bump or dent produces a wavefront distortion of one-tenth times 1.5 minus 1, or one twentieth wave. In other words, the distortion is less than the physical defect.

Designing and Building the Lens

I can't go into detailed lens design, but I can relate some personal experience in casting lenses. After all, most of us started in microwaves by using dish or horn antennas we found through surplus sales or hamfests. Then, as special needs arose, we designed and constructed custom antennas. The majority of dish and horn antennas used by amateurs fall into the found or purchased category. Few of us actually build them. I have built a couple of special purpose dishes, but will opt for an already-built one any chance I get—I'm basically lazy. (See "The Amazing Cylindrabola" by John M. Franke WA4WDL, *73*, September 1983.)

Several years ago I came across a large glass lens at an antique flea market. I've been keeping it for use as an optical receiver antenna. It is 6 inches in diameter, about 1½ inches thick, and quite heavy. It has a focal length of about 6 inches. The lens is flat on one surface and convex on the other, so it is known as a "planoconvex." Such a large fat lens is poor for optical imaging, but it's a great light collector. However, I needed two antennas. So, I decided to try to cast epoxy resin replicas of the glass lens.

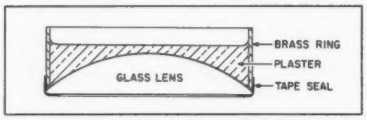

Figure 1. Forming the plaster mold.

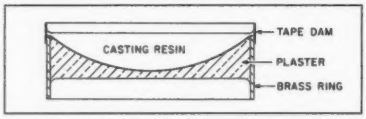

Figure 2. Casting the replica lens.

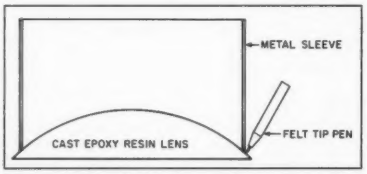

Figure 3. Marking the cast lens for edging. Note that the marking sleeve or cylinder must be perpendicular to this rear surface of the lens.

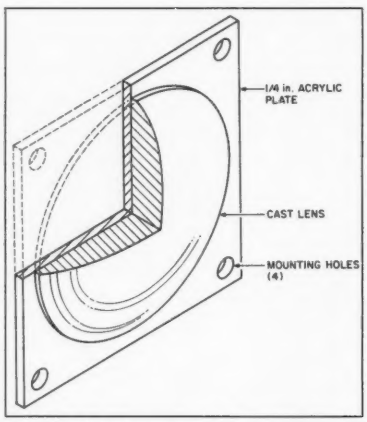

Figure 4. Cast lens epoxied to acrylic support plate.

In my junk box I found a couple of brass rings 6 inches in diameter and 2 inches tall. If I had not had the rings, I could have made suitable rings or sleeves by forming strips of aluminum flashing into a band and taping it to hold its shape. I placed the glass lens on the first ring, curved surface down, then taped the glass to the metal edge with plastic electrical tape, forming a watertight seal. (See Figure 1.)

Next, I mixed plaster, poured it into the mold, and let it harden for several hours. (See Figure 2.) Once the plaster had hardened, I removed the tape, separated the glass lens from the first ring, and taped it to the second ring. Then I poured the second mold and let it harden. (I let both plaster castings dry thoroughly for two days before doing any more work.)

In Photo A you can see several screws protruding through the sides of the brass rings into the plaster. The screws are there to plug existing threaded holes in the rings. They have no other real function, but they may be helpful in holding the ring and plaster mold together.

Once the plaster had dried, it was time to cast the lenses. One mold would have been sufficient, but I wanted to mix the epoxy resin only once. So, I made two molds to have added assurance against having to throw out the mixed resin if I dropped or chipped a mold after the resin was mixed. I placed the molds on a level surface with their smooth cast surfaces up. (If the molds are not level, the rear surfaces of the lenses will be wedged.) A strip of plastic electrical tape was used to form a straight wall lip at the top of each mold. I mixed the hobby casting resin using the least amount of catalyst recommended. This lengthens the curing time, but reduces the

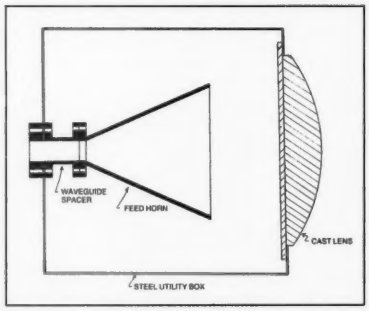

Figure 5. Completed antenna mounted in a 6-inch cube utility box.

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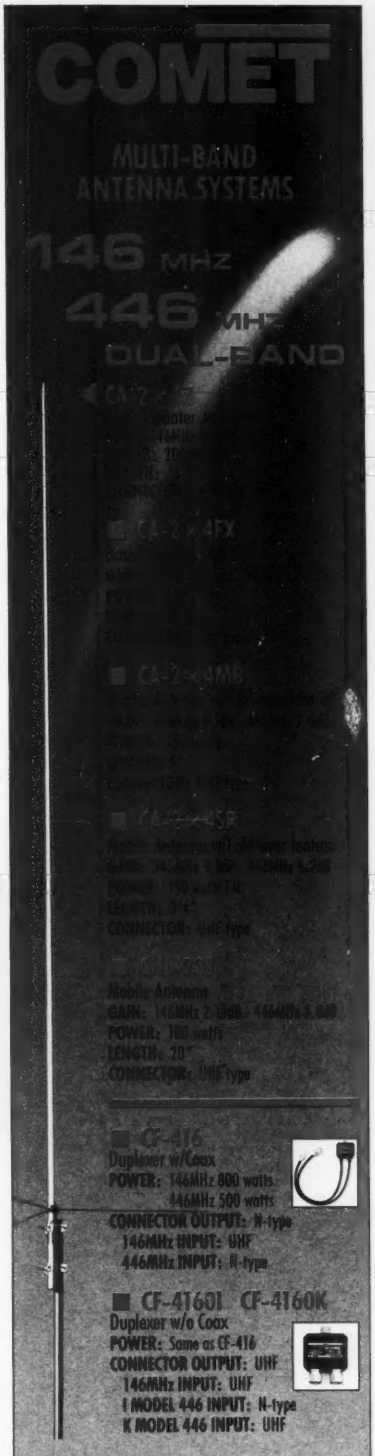

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chances of uneven curing and cracking due to rapid heat build-up. Next, I poured the resin and allowed it to cure overnight. The curing site should be outside to eliminate any problems with the smelly fumes.

The next day, I separated the cast lenses from their molds. The molds survived and could be used again. The edges of the lenses were rough and chipped, so I decided to trim or "edge" the lenses. I used a cylinder with an outside diameter of 5 inches—the hood from an old oscilloscope—to mark the lenses. (See Figure 3.) The actual edging was done with a disk sander and only took a couple of minutes for each lens. After the edging, the next task was to mount the lenses. Normally, lenses are mounted in a finely-machined barrel with a threaded retaining ring. I can operate a lathe and chase threads, but let's be reasonable! Instead, I epoxied a 5½-inch-square piece of ¼-inch acrylic to the flat surface of each of the epoxy lenses. (See Figure 4.) Then I drilled four mounting holes in each acrylic square.

Light sanding of each lens, followed by a couple of coats of clear acrylic spray, finished the lenses. The sanding is for two reasons. First, although the lenses are of poor optical quality, they can still produce a very hot spot when aimed at the sun, unless their surfaces receive a ground scattering finish. Second, they look better with an even, frosted appearance.

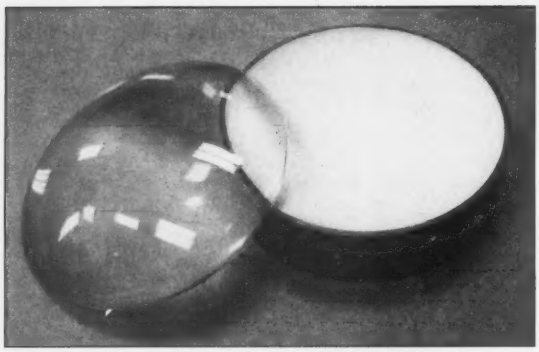

Photo A. Original glass lens and plaster mold.

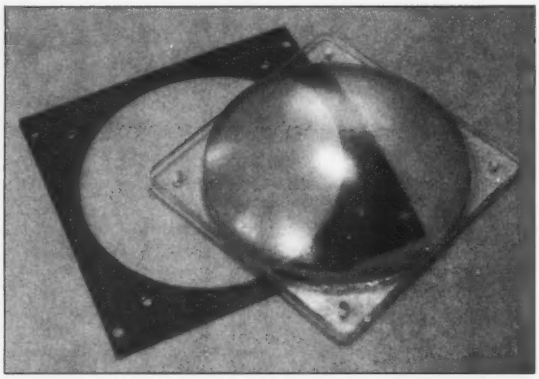

Photo B. Cast lens epoxied to acrylic plate and lens mounting plate.

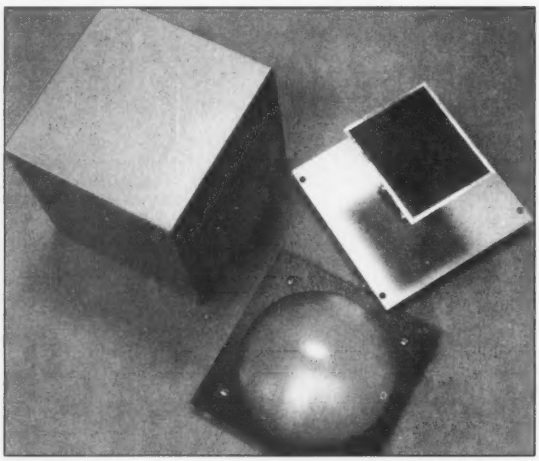

Photo C. Mounted lens, mounted horn and complete antenna.

Testing the Lens

One nice thing about small aperture microwave antennas is that you can set up a test range in a short distance. For example, with a small horn source antenna and the cast lenses, a distance of 20 feet is more than adequate. For a source, I used a surplus 2K25 klystron that had its cavity stretched to operate on 10.4 GHz. (See "A Complete X-Band Transmitter" by Stirling M. Olberg W1SNN, *73*, August 1978.) People may shun vacuum tubes, but I can only respect a tube that, like me, is over 40 years old and still working. Besides, have you priced a Gunn diode lately? I would very much like to hear from anyone with a supply of Solfan Gunn diode units. Anyway, the 2K25 puts out about 25mW when used with an old surplus klystron power supply that I got at a hamfest many years ago. The receiving portion of my antenna range is a 0–40 dB attenuator and a tunable detector mount. For metering, I now use a circuit published by Chuck Houghton WB6IGP. (See "Microwave Test Equipment for 10 GHz" by Chuck L. Houghton WB6IGP, *73*, October 1988) I did have to reverse the polarity of the detector diode to get it to work, probably due to a misprint. His circuit is very compact and very sensitive. You cannot go wrong reading his many articles, and he now has a superb column, "Above and Beyond," in *73* every month.

I placed a standard gain horn on both the transmitter source and the receiving setup, and tuned the detector mount for maximum response. Then I set the S-meter to midscale by adjusting the variable attenuator. The attenuator setting at this point became my reference reading. Substituting other antennas on the receiver setup, the attenuator is changed to maintain a midscale meter deflection. The reference reading is subtracted from the new setting. The result is added to the gain of the reference antenna to yield the gain of the new antenna.

Sound more complicated than it actually is? Say you have a reference antenna of 16 dB gain and with it you get a reference attenuator setting (reference reading for midscale meter deflection) of 8.5 dB. Putting your test antenna on the receiving setup, you get a midscale meter deflection with the attenuator changed to a setting of 12 dB. Then, subtracting the reference reading ($12 - 8.5 = 3.5$ dB), you find that the test antenna has a gain 3.5 dB greater than the reference. You have to attenuate the signal from the test antenna to make it equal to the reference signal. The gain of the test antenna is the difference added to the gain of the reference antenna ($16 + 3.5 = 19.5$ dB). If the midscale deflection had required an attenuator setting of 4 dB for the test antenna, then subtracting the reference reading ($4 - 8.5 = -4.5$ dB) tells you that the test antenna has a gain of 4.5 dB less than the reference, or a net gain of $16 - 4.5 = 11.5$ dB.

You do not need to know the absolute gain of an antenna to use this technique. As long as you use the same antenna as a reference, you can measure the relative gain of your other antennas to it. After all, we are more interested in reducing losses or improving gains than we are in knowing what the absolute levels are.

Back to the lenses. The lenses, having a focal ratio (or F#) of about 1, should be fed with some sort of small horn antenna. I used the only one I had at the time—a Microwave Associates metalized plastic 17 dB gain horn. The addition of the epoxy lens increased the gain by 4.5 dB, or a factor of 2.8. With a unit at each end of a path, the net system gain is 9 dB, allowing the usable separation to be increased by 2.8 for equal signal strength. I was able to mount the lenses on one face of a 6-inch cube steel utility box and mount the horn with a spacer on the opposite face of the box. The result is a compact, easy-to-handle unit that can be readily mounted on a tripod for field work, or on a tower for point-to-point applications. (See Figure 5.)

I am now looking for a larger lens to cast, or perhaps I can find a large bowl to serve as a mold. 73

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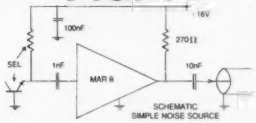
It is often desirable to see the performance of RF devices over a large frequency range. Viewing with a medium sensitivity logarithmic system, such as the 107 Spectrum Probe® or spectrum analyzer, is needed. Finding a signal source is the other problem. A signal generator can be manually varied over the range. This is the most accurate, but it is very slow — especially if band changes and leveling must be adjusted. A swept generator can be used, but viewing is difficult unless the generator frequency is locked to the spectrum analyzer frequency.

FIG. 11



An inexpensive solution is use of a noise source which generates a medium, but essentially constant, level of noise over the frequency range of interest. I designed my own (fig. 11) using the emitter-base diode of the "noisiest" (but constant with frequency) transistor I could find. The diode is reverse biased to break down, with the current adjusted for maximum noise. This is connected to a high-gain wide-band amplifier.

The Spectrum Probe® display of fig. 12 shows the noise output, using the coaxial adapter and suitable termination. The noise generator is replaced by a −30dBm/7mv signal generator and this CAL also plotted in fig. 12. The small variation between noise and CAL indicates a nearly constant noise level. A 0.047 μF capacitor across the scope input will reduce the noise bandwidth.

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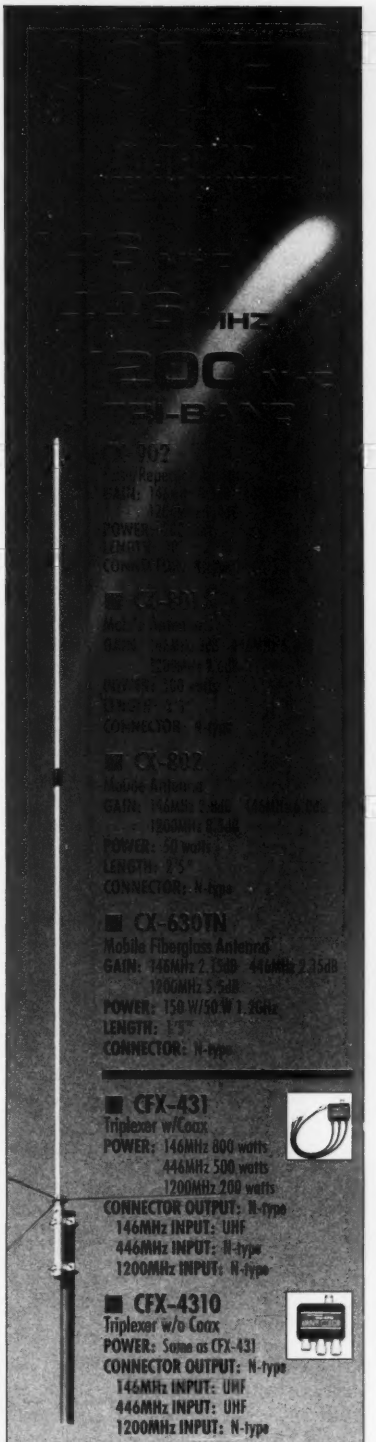

■ **CX-630TN**
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GAIN: 146MHz 2.15dB 446MHz 2.35dB 1200MHz 5.5dB
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CONNECTOR: N-type

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146MHz INPUT: UHF
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CIRCLE 54 ON READER SERVICE CARD

The Microwave Directory

Where to find a wide range of goodies for operation at 902 MHz and above.

by Pete Putman KT2B

Ever wondered where to find chip capacitors? Low loss microwave relays? Power dividers? Isolators? Schottky diodes? Or perhaps you need a medium-power gain block to drive the high power amplifier you also need! Or tubes for it. Or even an antenna array. Stymied?

Hopefully, you won't be after reading through this compilation of microwave sources. I've spent a good deal of time rooting out sources for anything from ATC chips to Z-match devices. . .to help get your next project rolling. While this list is by no means exhaustive, it IS extensive and represents businesses from all over the US and Canada. In most cases, the proprietors are also amateurs, active in a wide variety of microwave operations.

Take a careful look. There are some really neat items available, and all at prices that won't break the bank! Most of these dealers will supply you with a catalog upon request. Each is listed with a brief description of the product(s) sold and any observations I have from past dealings. So, without further delay. . .

Advanced Receiver Research
PO Box 1242
Burlington CT 06013
(203) 582-9409
VISA/MC accepted

Jay Rusgrove W1VD has been building some beautiful preamplifiers over the years, and makes a nice sequencing board for mast-mounted types. ARR also sells the TR10GA Gunnplexer/Transceiver combination for wideband 10 GHz FM work as well as the TR24GA system for 24 GHz. A line of microwave preamps is in the works. Catalog available.

Bob Seydler
Rt. 2 Box 2170
Boerne TX 78006
(512) 650-3001 Days; (512) 249-2152 Eves.

Bob N5KET and Alan Dickinson N5BHX have accumulated a huge quantity of surplus microwave equipment, ranging from power amplifiers, isolators, Gunn diodes and Gunn oscillators, PLL/DRO oscillators, complete transceivers and components. PHEW! If you can't find it here, then where? Price list available.

Communications Concepts, Inc.
508 Millstone Dr.
Xenia OH 45385
(513) 426-8600

A source of hard-to-find chip caps, RF power transistors, and kits for VHF and UHF. Catalog available.

Distributor Specialists
1942 14th Street
Santa Monica CA 90404
(213) 452-3445

Distributor Specialists carry a full line of high-power relays including Dow-Key Type 60 and 260 series and Marshall CX500 series. Price list available.

Down East Microwave
Box 2310 RR1
Troy ME 04987
(207) 948-3741
VISA/MC accepted

Home of the famous "loopers"! Bill Olson W3HQT is the proprietor, and in addition to loop yagi kits for 903, 1296, and 2304 MHz, he manufactures a line of linear solid-state amplifiers for 903 and 1296. Power levels range from 3 to 70 watts output. In addition, Down East carries the SHF Systems series of transverters for 902 through 5760 MHz. Low noise preamps and kits are available for 432 MHz through 10 GHz. Catalog available.

EMCOM Industries
Ed Emich
10 Howard St.
Buffalo NY 14206
(716) 852-3711

Contact Ed Emich KB2KHK for waveguide and 10 GHz frequency meters. He also can design prototype specialty microwave items for your specific needs.

Frontier Microwave
RD1, Box 467
Ottsville PA 18942
(215) 795-2648 Eves.

Dave Mascaro WA3JUF has been building solid-state gain blocks for quite some time, and offers a line of custom-built amplifiers to cover the spectrum from 902 to 2304 MHz, with power levels from 10 mW to 50 watts. He also builds low-noise preamplifiers for 902 and 1296. They're good for a variety of applications as low-level drivers or final stages. Price list available.

Hamtronics, Inc.
65 Moul Rd.
Hilton NY 14468-9535
(716) 392-9430

A lineup of kits and modules for VHF and UHF including 900 MHz. High quality and economical GaAsFET preamp kits from 10m through 70cm. Catalog available.

Hi-Spec Company
PO Box 387
Jupiter FL 33468
(407) 746-5031

If you're ready to add a bit of power to your microwave signal, Hi-Spec would be a good place to start! A full line of cavity amplifiers is available for 902, 1296 and 2304 MHz. And you can now gang 'em up with the Hi-Spec line of modular RF decks, using a common high voltage supply (yours or theirs). Up to 200 watts out can be obtained on 903 and 1296, with up to 100 watts available on 2304. . .a potent punch. Price list available.

Microwave Components of Michigan
PO Box 1697
Taylor MI 48180
(313) 753-4581 evenings

Another regular visitor to Dayton! Norm Alred WA8EUU is the proprietor, and he's got quite an assortment of hard-to-find com-

ponents, such as chip and leadless capacitors, chip resistors, microwave diodes, GaAsFET devices, MMICs, piston trimmers and SMA connectors as well as a lineup of Mitsubishi power modules. Norm also builds some nice low-noise preamps from 6m to 1296 MHz. Price list available.

Mountaintop
P.O. Box 178
Somis CA 93066
(805) 482–0320
(Answering machine during daytime or contact directly after 7 pm PST)

John Kitchens NS6X offers a selection of surplus VHF, UHF and microwave parts. He also has MA/COM 10 GHz Gunnplexer systems as well as sideband units for 10 GHz. He still has some of the popular Tonna antenna line in stock.

Pauldon Associates
210 Utica St.
Tonawanda NY 14150
(716) 692–5451

Preamps and power amplifiers for 2m up to 1.2 GHz. Bricks and exciters for 70 cm, 900 MHz and 1.2 GHz. Catalog available.

PC Electronics
2522 Paxson Lane
Arcadia CA 91007
(818) 447–4565
VISA/MC accepted

Always wanted to be TV, eh? Tom W6ORG and Maryann WB6YSS O'Hara can satisfy your craving with a full line of ATV transmitters and accessories for 70cm, 902 and 1296 MHz. Receive converters are also available, and you can even buy the boards to "roll your own" ATV station. Amplifiers and antennas round out the equipment list. Catalog available.

RF Parts
1320 Grand Avenue
San Marcos CA 92069
(619) 744–0728, (800) 854-1927 order line

All kinds of RF power transistors and parts for VHF and beyond. Power modules (bricks) for a variety of bands and input power are available to help simplify amplifier projects. Specialty tubes can be had as well. Catalog available.

Satellite City
2663 County Road I
Moundsville MN
(612) 786–4475
(800) 426–2891

An economical source of 18″ and 24″ dish antennas as well as Gunnplexers and associated equipment. They also have some real deals on used satellite equipment for FM ATV experiments.

SHF Microwave Parts Co.
7102 W. 500S
La Porte IN 46350

Alan Rutz WA9GKA carries a smorgasbord of equipment for 10 GHz experimenters. Gunnplexers, Gunn diode sources, horns and waveguide are among some of his offerings.

Sinclabs Inc.
Specialty Products Div.
85 Mary St.
Aurora, Ontario, Canada L4G 3G9
(416) 841–0624
In the U.S. contact:
East Coast Amateur Radio
496 McConkey Dr.
Tonawanda NY 14150
(716) 835–8530

For those high-power enthusiasts, Sinclabs produce a nice series of water cooling jackets which mount on a 2C39, 7289 or 7815 tube. Also they offer 900 and 1296 MHz 2-way power splitters. 10m to 2m or 220MHz transverters are available as well. Catalog available.

Spectrum International
P.O. Box 1084-S
Concord MA 01742
(508) 263–2145

For years John Beanland G3BVU/W1 has carried the fine line of Microwave Modules transverters and converters. Although Microwave Modules no longer supply the ham market, he still has some 1296 transverter boards available. He will continue service and repair for any of the units out in the field. John carries a lineup of loop yagis for 1268, 1296 and 1691 MHz as well as a series of high quality interdigital band filters from 420 MHz up to 1691 MHz. ATV channel filters are available designed for specific frequencies. He also offers a wide range of equipment for GOES weather satellite reception on 1691 MHz including a complete high quality system. Look for more interesting transverter packages in the coming year. Catalog available.

SSB Electronics USA
124 Cherrywood Dr.
Mountaintop PA 18707
(717) 868–5643 M–F after 6:30 p.m. Any time on weekends.

Gerry K3MKZ carries the high quality SSB Electronics series of transverters from 6m all the way up to 10 GHz. Also a line of preamps for EME, OSCAR and weak-signal work both mast-mounted or in the shack. A mode S receive converter is available as well. Check out their 100 watt amp for 1200–1300 MHz. A 40-page catalog is available for 85 cents worth of stamps.

Steve Kostro
Box 341A RD1
Frenchtown NJ 08825
(201) 834–1304 9 a.m.–7 p.m.
(201) 996–3584 after 9 p.m.

Steve N2CEI is another "partsmonger" and at hamfests he sets out a tray of components that looks good enough to eat. You'll find all kinds of bipolar and GaAsFET devices available as well as MWA and Avantek MMICs; HP-5082 diodes, chip components, helical filters, connectors and Teflon™ PC board material. Steve also sells a line of GaAsFET kits based on the WB5LUA designs for 902, 1296 and 2304 MHz. Price list available.

Surplus Sales of Nebraska
1315 Jones Street
Omaha NE 68102
(402) 346–4750 or (402) 346–2939FAX
Compuserve 76357,3664
VISA/MC/AMEX accepted

The catalog alone is worth an inquiry! Surplus Sales is a familiar face to Dayton attendees and has an incredible range of new and used parts for sale. It would be impossible to list them all, but items in Catalog #5 of interest to microwave fans include feedthrough capacitors, 7289/3CX100 tubes, RF connectors, coaxial relays, attenuators, and power modules. (And I'm only up to page 21!!)

T.D. Systems
2420 Superior Dr. 'B'
Pantego Tx 76013
(817) 861–5864

Steve Franklin WB5KGL has designed a series of AM and FM ATV transmitter and receive modules (along with a video control center) for the 70cm, 900 and 1200 MHz bands. They are designed for mast mounting to eliminate feedline losses. Catalog available.

TE Systems
P.O. Box 25845
Los Angeles CA 90025
(213) 478–0591

A series of medium to high-power amplifiers for the 144, 432 and 1296 MHz bands complete with built-in GaAsFET preamps. Catalog available.

The Antenna Center
505 Oak St.
Calumet MI 49913
(906) 337–5062

A good source of high quality spun dishes specifically designed for high accuracy at the 12 GHz Ku satellite band. These should be great performers on the amateur microwave bands and come in sizes ranging from 2 feet to 6 feet. The 2- and 3-foot models are UPS shippable. Price list available.

The RF Connection
213 N. Frederick Avenue #11
Gaithersburg MD 20877
(301) 840–5477
(800) 783-2666 orders
VISA/MC accepted

If it has anything to do with a connector . . . Joel Knoblock probably has "it" somewhere in his vast inventory of connectors, adapters, coaxial cable, switches and relays. Joel is a regular at major hamfests, including Dayton, and has even come out with his own "house brand" type 9913 coax. Price list available.

VHF Communications
280 Tiffany Ave.
Jamestown NY 14701
(716) 664–6345
(800) 752-8813 orders only
VISA/MC/DISCOVER accepted

A source of Hamtronics kits. Price list available.

Continued on page 55

73 Review *by Jeffrey J. Covelli WA8SAJ*

The Commander II Amplifier

For more fun on 2 meters.

Command Technologies, Inc.
1117 W. High Street
PO Box 939
Bryan OH 43506
Tel: (800) 736–0443; (419) 636–0443
Price Class: $1388 w/Dow-Key 260-B.
Price Class: $1140 w/o 260-B.

The Commander II amplifier, manufactured by Command Technologies, Inc., is a 2 meter operator's dream come true. It uses a single 3CX-800A7 in a grounded-grid configuration, running in class AB2. The tube itself is capable of 800 watts plate dissipation, which is comforting since the amplifier can put out almost 1000 watts SSB with 25 watts of drive! And all this high power is in a compact, self-contained table-top unit (see Photo A). The amplifier weighs 56 pounds, most of its weight due to the heavy duty transformer used for the 2500-volt, high voltage supply and 12-volt control voltages.

The layout of the amplifier is straightforward and clean. The final amplifier section is in a completely RF-tight enclosure mounted inside the cabinet. It contains the 3CX-800A7 tube with a Teflon™ chimney. The blower is a 50 cfm Dayton squirrel-cage type, which moves plenty of air around the tube, but it won't knock your ears off while running (see Photo B).

Photo A. The front of the Commander II.

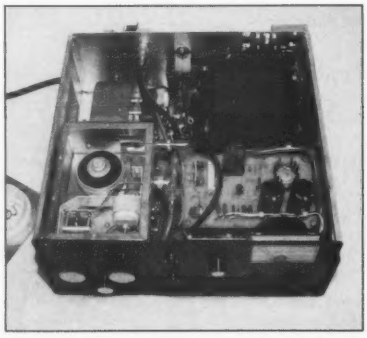

Photo B. Under the cover, a quiet fan keeps things cool.

Input and Output Circuits

The input circuit is a high *Q*-tuned type which provides excellent linearity and low SWR for the exciter. I found the tuning to be sharp, though very manageable thanks to the 6:1 vernier gear drive connected to it.

The output circuit uses a quarter-wave stripline design with a high *Q* piston-type plate tuning capacitor, both of which are machine fabricated of brass then silver-plated. This tuning capacitor moves in and out of a fixed cylinder attached to the stripline. Teflon™ is used for the dielectric, and there is no problem with arc-over since the capacitor is rated at 2–26 pF at 10,000 volts.

Two pre-sprung straps, which give while turning on a screw-type shaft, ground the piston. The tuning capacitor and loading capacitor are connected to 6:1 vernier gear drives for smooth tuning. High voltage enters the plate circuit through a mil-spec "MHV" connector similar to a BNC. Bypassing is done at the connector with a 0.005 µF capacitor at 5 kV, and an open-air type RF plate choke in series with the high voltage lead is attached to the tube by a collar wrapped around the plate. The filament supply is bypassed at the input terminals, and RF chokes are in series with the supply voltages.

RF Flow

As the RF leaves the output circuit through the SO-239 connector, it meets a "T" connector, one side having a quarter-wave shorted stub and the other side having a piece of ¼" heliax for the output, which is attached to the Dow-Key 260-B RF relay (the relay is optional; see "Price Class" above). The blower output to the tube is shielded by a stamped-out top cover plate with enough surface area to keep the RF inside; however, there is plenty of air output during operation. The entire RF section uses machine screws and lock-washers to provide excellent RF shielding and grounding.

Typical RF Output Ratings for the Commander II

Watts Drive	Watts Out
5	120
10	320
15	450
25	700

The Power Supply

With all this attention to a highly efficient RF section, the next question that pops up is, where is the power supply? It's in the same compact cabinet as the RF section, but completely separate from it. The Commander II comes wired for 110 VAC, with a large seven-foot #14-3 conductor AC cord. This was a pleasant surprise, and definitely needed to keep the voltage drop down on the primary supply at full output. The amplifier can also be wired for 220 VAC, which I did, and I noticed better regulation as a result.

The filament transformer is not part of the high voltage transformer. This provides for better regulation and no voltage drop at the filaments under full load. The high voltage transformer is large and heavy, 28 pounds worth, exactly half the weight of the amplifier. It sends 900 volts AC to a voltage doubler that generates about 2500 volts DC with 27.5 µF of filtering using eight 220 µF, 450-volt capacitors. A 50-ohm, 50-watt resistor in series with the high voltage lead limits the current in the event of a short or flashover in the tube.

A single meter switched in and out using a multiple pole switch mounted with a small PC board on the back, provides plate voltage, plate current, and most importantly, grid current. The control board, mounted on top of the high voltage board, gives the two-minute time delay needed for the cathode of the tube to warm up before operation can begin. The regulated 12 volts for relay control, and a zener diode for proper class AB2 bias, are also a part of this board.

Operating the Commander II

The operation of the Commander II is very easy. When you turn on the amplifier to warm it up, the meter's lamp lights up and high voltage is present on the plate of the tube. The green lamp will come on when the two-minute

delay circuit is complete, and at that point the amplifier is ready to go.

The 12-volt relay circuit requires a hard contact closure to ground rated at 150 mA of current draw. When you key the amplifier without drive, the plate current reads about 120 mA, and the grid current should be zero. I found no erratic plate or grid current readings at this point while tuning the plate and load controls along with the input tuning. This means the amplifier is very stable and won't go into oscillation while the drive is still at zero.

The nominal input drive is 10 to 15 watts, while 25 watts is maximum. As seen by the table, even 5 watts will give over 100 watts output. This amplifier really runs well. I found its efficiency at about 60% or better, depending on the drive. Wiring the amplifier for 220 VAC resulted in better regulation, with about a 150-volt drop in the high voltage supply at full output. If you have a dedicated line for the amplifier, it can run fine at 110 VAC, drawing close to 14 amps at full output.

Easy to Tune

Overall, tuning is straightforward. For the most part you are looking for maximum output while checking to make sure the grid and plate currents are not exceeded. I used a Bird Model 43 with various elements, up to 1000 watts for all tests. My own station consisted of a multimode Yaesu FT-901DM, with the FTV-901R transverter at 15 watts for some of the testing; and a multimode Yaesu FT-736R VHF and UHF rig at 25 watts for the high power testing.

My transverter only had 15 watts, but even at that level my output was still 450+ watts! With the 25 watts from the FT-736R, this amplifier really puts out the power—at least 700 watts! And if you really watch the grid/plate current and don't exceed maximum ratings, you can get almost 1000 watts power SSB.

On-the-air checks while running SSB were all very good, and I had no bad reports of audio distortion or splatter up and down the band. In fact, most people commented on how good the amplifier sounded! Putting the amplifier in and out of the line was fun, since the gain difference is about 15 dB! And that's really handy when trying for that extra grid square on 2 meters.

I also run plenty of FM simplex with key-down times of 5 to 10 minutes for each "go-around" during an entire evening. There has been no problem with the amplifier as long as I keep the power output around 400 to 450 watts. Don't let it get any higher than that on FM unless you want to purchase a new tube soon! After having the opportunity to run this kind of high power on 2 meters for the past couple of months, I see a whole new world open up.

Most of the rigs today have good receivers, but unless there is something such as the Commander II in the output, the score is not even. I was always hearing very well, but now I can work anything that comes through on the receiver!

One final note: I am really glad to see an all-American company producing such a well-made piece of equipment! 73

Contact Peter Putman KT2B at 3353 Fieldstone Dr., Doylestown PA 18901.

Continued from page 53

Wyman Research, Inc.
R.R. #1, Box 95
Waldron IN 46182
(317) 525-6452

Don Miller W9NTP offers a lineup of FM video transmitters and receivers for the 900 and 1200 MHz bands. He also carries a series of AM ATV transmitters, receivers and transceivers for the popular 70cm band as well. Catalog available.

Well . . . there you have it. Again, the list is by no means exhaustive! Surely there are more entrepreneurs out there peddling microwave components at hamfests than I know about. And, of course, I purposefully omitted the major manufacturers who already heavily advertise their microwave products, such as transceivers and preamplifiers for 23 centimeters.

Clip this article out (or put this issue aside) to use the next time you come up against a wall when searching for parts or whole assemblies. Amateurs are supposed to be a resourceful lot. Above 900 MHz, you haven't much choice! This will make the job easier.

See you on 902 . . . 1296 . . . 2304 . . . 3456 . . . 5760 . . . 10368 . . . etc. . . . 73

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HOMING IN

Radio Direction Finding

Joe Moell, PE, KØOV
PO Box 2508
Fullerton CA 92633

Leveling the Field

In Radio Direction Finding (RDF) contests, as in every other sport, it's important for winners to be determined by fair and uniform methods. One of the students in our local beginners' ham class is a former world class ice dancer. He has told us horror stories of the subjective scoring system for competitions. Standings are determined by a panel of judges, and "hype" appears to be as much a factor as talent and skill in winning the gold.

Fortunately, foxhunt winners aren't picked that way. We can use objective criteria for scoring. But which criteria to use and how to apply them can lead to controversy. It's important for all hunters to feel that they have a fair chance of winning, or they won't participate regularly.

And. . . They're Off!

An obvious method for selecting T-hunt winners is to use a watch. Everyone starts hunting simultaneously, and the first finder wins. Easy, right?

This method is the favorite of the "sportsman" type of hunter, as well as those who view foxhunting primarily as practice for jammer hunts or search/rescue missions, where speed is all important.

But many foxhunters abhor time-only hunts. "These hunts favor the athletic hunters and the daredevils," they say. In an on-foot hunt, a participant with a physical disability is at a disadvantage. In vehicle hunts, time factors discourage safe, courteous driving skills. Other hunters may be willing to push the speed limit. Are you?

The biggest complaints about time hunts arise when locals and out-of-town hunters face off. Traditionally, San Diego (California) hunts are always time-only events. When San Diego hams host a big convention and put on a T-hunt, many Los Angeles and Santa Barbara area attendees gripe about the likelihood of the San Diego teams winning all the prizes, because they know the fastest routes on the local freeways and highways. Of course, these gripers usually don't participate in that hunt, so it becomes a self-fulfilling prophecy.

Maintaining interest on a long timed hunt can be difficult. If the hider lets it slip out that at least one team has found the T, the other hunters know that they cannot win. They may quit at that point and go home, unless the hider can keep them going by baiting them, promising them snacks, etc.

Some club rules allow hunters to start anywhere, perhaps on a hilltop close to their home. Almost always, these are time-only hunts. Of course, there is an element of luck involved, because some hunters will start much closer to the T than others.

Another problem occurs when teams get the same start bearing and follow one another. It's bad enough when it causes a drag race on a vehicle hunt, but it's even worse when foot-hunting. The first finder must be careful not to give away the location of a concealed T to others who are sniffing nearby.

World class foot-hunt competitions often use a "staggered start" to avoid this problem. Competitors start at regular intervals, and each of them is independently timed from start to finish. That's fine for a European radiosport championship, where there are plenty of judges available to do the timing, but it's impractical for small club outings when everyone wants to hunt and no one wants the timing chores.

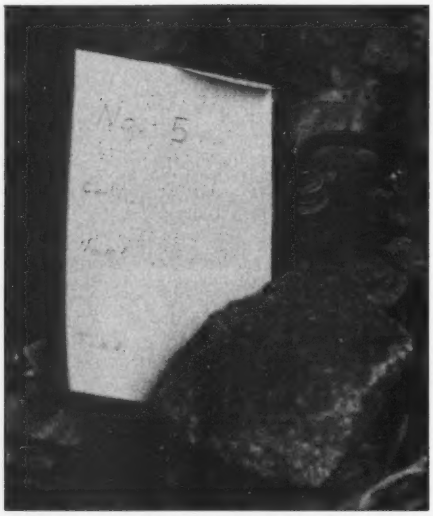

Figure 1. No, this isn't a special set-up shot. The two meter hidden transmitter was actually buried and concealed with leaves like this. Four teams have found it and taken their "tickets" from the note pad. (Photo by WB6UZZ)

Is Mileage Better?

Of the 15 monthly hunts in the greater Los Angeles area, only three use time as the sole factor for winning. The rest use mileage, either as the only factor or the most important factor. Using odometer mileage eliminates racing and timing problems. It helps level the field for new competitors, who are less familiar with local geography and the operation of their RDF gear.

Eliminating time as a factor encourages hunters to be careful and methodical. Mileage hunts are preferred by "engineer" types (like me) who view a T-hunt as a field experiment in propagation and navigation, instead of as a blood sport.

Mileage hunts can be almost as simple as timed hunts. Odometers are read at the beginning and the end point. The lowest mileage wins. Traffic tie-ups, poorly-timed stop lights, long freight trains, and open drawbridges don't ruin your day on a mileage-only hunt.

Mileage hunts have their own problems, however. Some hunters take advantage of the lack of a time penalty and hunt v-e-r-y slowly, perhaps stopping for leisurely meals along the way. Needless to say, this is very annoying to the hider, who wonders when he or she will get to go home.

If an on-foot search is involved at the end of a mileage hunt, it's easy for some lazy or poorly equipped teams to hang around and watch someone else try to ferret out a carefully concealed transmitter (see Photo A), instead of going after it themselves. After all, they found the parking area, so their place in the finishing order has already been determined by their mileage. There is no incentive to dig out the sniffing gear.

What's Your Crenshaw?

The biggest problem with mileage-only hunts is odometer calibration.

Whenever teams finish with mileages a percent or two apart, there will be controversy. I am told that continuing odometer arguments led to the San Diego hunters changing to time-only hunts. One or two teams always had significantly lower mileages than the others, some appearing to be impossible to achieve by any route.

On very long distance events, such as the Southern California All Day Hunt, where the transmitter is often 200 air miles away, a five percent odometer error (quite common) frequently changes the order of finish. That is why a standard method for normalizing mileages was devised. It's called the Crenshaw Factor, because each hunter calibrates his odometer by driving a carefully-defined section of Crenshaw Boulevard on the way to the starting point.

Hunters read their odometers with the nose of the vehicle alongside a telephone booth in front of a certain doughnut shop, then drive in the left lane to the stop sign at the starting hilltop and read it again. The elapsed mileage is the vehicle's Crenshaw Factor, usually about nine miles.

It takes only a few seconds with a calculator to determine the winner of a close hunt with Crenshaw Factors. Just divide each hunter's odometer hunt mileage by his or her Crenshaw Factor. The results, in Crenshaw Units, are compared. The winner has the lowest number. Some hunters don't like results to be expressed in Crenshaw Units, so they multiply the Crenshaw Units by 9.0 to get approximate corrected mileages.

That explanation may seem a bit complicated, but actually it's very simple and quick to do. "What's your Crenshaw?" is being heard at the end of hunts quite often, even the shorter ones. There are far fewer disputes, merely occasional snide comments about the "inflation" of claimed Crenshaw Factors over time.

Pick Your Combination

Mileage-only and time-only hunts each have good and bad features, as we have seen. This has led many clubs to adopt rules that include both time and mileage factors, trying to get the best of both worlds.

Most Fullerton (California) Radio Club hunters like their system, where the final score is the sum of odometer mileage, plus a time penalty of one-tenth mile per minute from start to touching the fox's antenna. Lowest hunter's score wins, of course. This system encourages careful triangulation and route planning, while also keeping the hunters moving along and forcing rapid sniffing. On the other hand, some feel that the time penalty turns this hunt into a road race.

Some clubs have additional methods of scoring that include keeping track of the progress of all participants over the course of the annual foxhunting season. In Lincoln, Nebraska, the first finder of each hunt gets 15 points, second gets 10, third seven, and so on. All participants, including navigators, get at least one point.

Even the hider scores in the Lincoln ARC system. He or she gets five points if not found in 30 minutes, and additional five points for each unfound 15 minutes after that, up to 25 points. Cumulative standings are updated monthly and posted in the club newsletter.

To make hunting more of a challenge in the flatlands of Nebraska, foxes transmit for two minutes, then are silent for three minutes. The hider uses the high power mode on the rig until one hunter requests a switch to low power. From there on, each transmission is one minute at high power and one minute at low power, to aid hunters who use rudimentary attenuation methods.

Now that you know the pros and cons of various scoring systems, your group can make up its own set of rules. Get started now, because the warm weather hunting season will be here soon. Be sure to take pictures of your group's most interesting RDF setups and clever fox dens. I am always looking for good photos and interesting hunt stories for this column. 73

An Inexpensive 10 GHz Dish System

The plumber's delight!

by Jerry Jensen WTØW

This design for a 10 GHz dish and feed system was born of necessity. There are few sources of microwave components here in the Midwest, so construction projects have to use available non-microwave parts. The only microwave part used for this system is one WR90 waveguide flange. Even that could be made of scrap material if you can't locate one easily.

The dish is an old 18″ surplus HBO dish left over from the days when premium channels were broadcast. It has a focal ratio of 0.4, providing a focal length of about 8.1″. The dish I found has a 1″ hole, conveniently located at its center, that permits the 10 GHz source to be mounted behind the dish and fed through it to a modified "penny feed." A chassis punch or drill could be used to make the hole on a solid dish. One of the old "flying saucer" dish snow sleds would also work if you modify the feed's length to meet the new focal ratio.

The feed system starts out as a 12″ piece of ¾″ copper pipe. Anneal one end of the pipe by heating about 2″ of the end until the surface looks very clean (don't get it red hot), then plunging the hot end into cold water. This will make the annealed end of the pipe very soft and easy to work. Place about ½″ of the end in a vise and squeeze the pipe with the vise until the pipe is an ellipse about ½″ wide. Next, rotate the pipe 90 degrees and do the same thing, but stop at 1″, at right angles to the first squeeze. By repeating the operation a few times, you will end up with an end on the pipe that fits the WR90 flange. Pliers and careful hammer tapping (with a sharp right angle piece of steel held inside the pipe) will make the corners of the squeezed pipe perfect. Be careful not to strike the copper hard enough to stretch it or you will end up with too large an opening.

Once the end of the pipe matches the flange, force a ¾″ outside pipe coupling (just a copper tube that fits over the joint of two ¾″ pipes) down the pipe to as near the flange end as possible. This will act as a spacer for the next plumbing piece, a 1″ male pipe threaded to a 1″ copper pipe adapter. Put the adapter over the pipe coupling with the male threaded end away from the waveguide flange. Some adapters fit over the coupling tightly, others are a bit sloppy. A layer of clean copper wire can be wrapped around the coupling, or a single turn used at the end(s) for spacers as needed.

Before the assembly is soldered, mount a 1″ galvanized pipe flange on the back of the dish over the 1″ feed hole in the center. Screw the copper adapter about halfway into the flange and measure the length of the pipe sticking into the dish. Check to be sure that the end of the pipe goes into the dish at least far enough to be within an inch of the focal point. If everything checks out, solder the waveguide flange to the pipe and the pipe coupling and adapter assembly. If you get any solder inside the end of the waveguide at the flange, use a small file to remove it.

Screw the feed assembly about halfway into the pipe flange, mark and then cut the copper pipe to make it about 1½″ short of the focal point.

At this point there is an option. If you want to be able to tear down the system into its most portable state for backpacking or such, you can make the splash feed removable. This will allow you to pull the feed system out of the dish. The feed system and splash plate can then be packed inside the dish.

The splash plate assembly is made from a male ¾″ pipe threaded to a ¾″ copper pipe adapter, a PVC (plastic) ¾″ female pipe threaded to a pipe adapter, and a 3¼″ copper disk. The PVC adapter is epoxied to the center of the copper disk. This is then screwed on to the pipe thread of the ¾″ copper adapter and the disk. For a completely portable system, drill and tap the copper adapter for a set screw to hold it to the feed system (an extra nut soldered to the outside might be wise). For fixed operation, solder the copper adapter to the radiating end of the feed system.

Tune Up

Tune up is simple: The radiating end of the feed has to be set to the dish's focal point. Then the separation between the end of the waveguide and the splash plate is adjusted for maximum radiation.

You will need some sort of power or signal strength measuring device to make these adjustments. It can be as simple as an unpowered Solfan unit. Just measure the mixer diode current of the unpowered unit when it is placed a few feet away from the dish with a sensitive current meter. Another Gunn transceiver could also be used to peak the signals.

The feed system can be adjusted by screwing the assembly into or out of the dish. The splash plate can be adjusted by screwing the PVC adapter further on or off the ¾″ pipe thread. These adjustments interact and should be made to optimize the gain of the system.

If you have built the portable system with set screws, be very careful not to distort the ¾″ copper pipe waveguide when you tighten the screws. If everything has been done correctly, the polarization of the output will be within a few degrees of the original source. If small dents or distortions are introduced into the pipe, the polarization of the output will rotate.

An 8-32 screw can be inserted into the center of the copper disk and adjusted to scatter the RF energy better as it hits the disk. The copper disk can be made from a piece of single or double-sided PC board. The PVC adapter could be machined from a better microwave plastic for lower losses. During the machining, a dielectric lens structure could be formed to optimize the scatter from the disk.

This disk and feed system may not be perfect, but it is a usable system that can be made from hardware store plumbing parts. Total cost, without the dish, should be less than $5. The feed illumination is good, and there is very little measurable radiation escaping the dish. Measurements taken across the dish (built with the dimensions shown) show a reasonable illumination pattern. 73

Contact Arthur J. (Jerry) Jensen WTØW at 10900 Ewing Ave. S., Bloomington MN 55431.

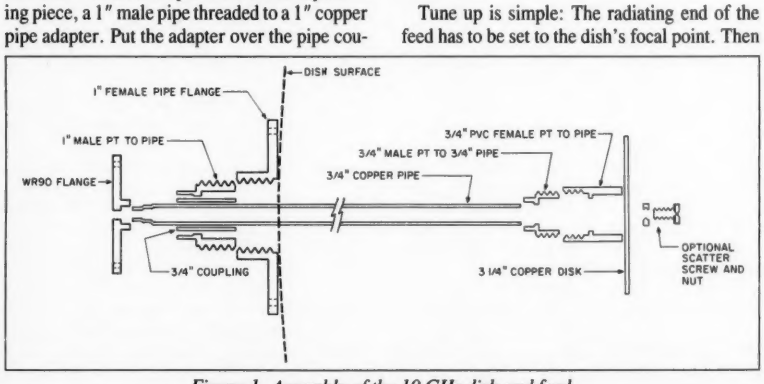

Figure 1. Assembly of the 10 GHz dish and feed.

Parts List

1	12″ length of ¾″ copper water pipe
1	¾″ male pipe thread to ¾″ pipe adapter
1	¾″ female—female pipe coupling
1	¾″ PVC female pipe thread to PVC pipe adapter
1	1″ copper male pipe thread to pipe adapter
1	1″ galvanized iron female pipe flange
1	WR90 waveguide flange
1	3¼″ copper brass disk

Note: 18″ and 24″ dishes are available from Satellite City, 2663 County Road I, Moundview MN; (612) 786–4475. Costs are about $20 and $30 respectively.

ABOVE AND BEYOND

VHF and Above Operation

C.L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake
San Diego CA 92119

Microwave Mixers

There are so many different types of microwave detectors available that I couldn't fully describe them all to you. What I will do is describe some of the more common types I've observed in surplus, the most familiar being the double balanced mixer (DBM) that's similar to the SRA-1. I have used this mixer in many different converters. You'll find various applications for it in almost any ARRL handbook.

Most devices run out of steam at 500 MHz; some special types, such as the TFM-1, are capable of operation up to 1500 MHz. But for our microwave bands, we need mixers that operate at frequencies from 2.3 GHz to 10 GHz and above.

Some prepackaged microwave mixers come with coaxial connectors attached to their three ports: RF (in/out), IF (in/out), and local oscillator, L.O., injection. Yes, that's "in/out," as any mixer can be used in receiving or transmitting. Mixer ports are labeled R (for RF), L (for L.O.), and X (for IF). Package styles can vary quite a bit. Usually, but not always, the bigger the package, the lower the frequency.

An SSB Modulator

At a flea market, I found a device labeled "SSB Modulator" that was 3½" high, 5" long, and ½" thick. (See Figure 1.) Quite a monster as mixers go. The price was right, so I picked it up. I thought it would be a 500 to 1.5 GHz low frequency mixer of some type, but when I tested it, it failed to perform at these frequencies. I opened it up to see what was going on.

Access to the inner parts was hampered by bolts epoxied and painted over. After scraping the paint off and picking the epoxy away with a knife, I was able to remove the bolts. The unit split into two sections (top and bottom plates), revealing the inner circuitry.

Looking at the circuitry, I could see it wasn't defective. The device was a very high frequency phase combining type of mixer. The actual mixer circuitry was about ¾" square, definitely not 1 GHz stuff. I put the unit back together and tested it at a much higher frequency, and found that it functioned in the 8 to 12 GHz range.

It's difficult to represent all the details of this mixer, but it uses four diodes and has combining striplines on both the top and bottom of the very thin PC board, coupling and phase canceling RF from port to port. This method achieves a high degree of balance, improving unwanted mixer products from either the USB or LSB inputs. Needless to say, I was excited.

If an item is inexpensive, take a gamble and pick it up; you do not know what you might be missing. True, the mixer could well have been another doorstop, but no gamble, no chance of winning.

Another type of mixer common on the surplus market is waveguide mixers. You can identify their frequency by the size of the attached waveguide. Figure 2 shows a typical waveguide mixer. This unit has two mixer diodes and usually comes with an internal preamplifier optimized around 70 MHz. This is a common IF for commercial systems. One of the waveguide ports is the RF input and the other is the local oscillator injection for the mixer. I have interchanged them with no ill effect.

Two caps about ½" in diameter allow you to service the detector diodes, if necessary. Note that this mixer only uses two diodes; one is positive and the other diode is reversed in polarity. The circuit works just like a full-wave rectifier in an AC/DC power supply.

Testing microwave detector diodes is simple, as they have a standard junction and will test like a basic diode. One problem is that the voltage rating and current permitted through these microwave diodes is quite low, and in testing them, use caution not to exceed limits. The old reliable 1N21 (6 GHz) and 1N23 (10 GHz) diodes used can be tested with a basic ohmmeter. Use the times 10 scale to limit current, and it will show you if the junction is still alive. This will not guarantee any figure of merit (noise figure) of the device. If the device is a good noise-figure type, you might want to wait until you can test it in a circuit.

I would not want to subject expensive diodes to the ohmmeter test. You must use good judgement, since some of the newer devices, such as GaAs types, will be destroyed or degraded by test voltages near 5 volts. I would limit the meter test to the 1N21 and 1N23 diodes. The GaAs type mixers have static-sensitive junctions and can easily self-destruct with improper handling. Test GaAs devices in a circuit, after the device is built, not with the ohmmeter.

A mixer similar to the waveguide type operates at lower frequencies. The waveguide may not be attached because a larger size is required. Normally, the waveguide ports are replaced with two "N" connectors on the opposite side from the detector diode caps. The basic body contains the same IF type amplifier described above. See Figure 3, which describes a mixer for 5.6 or 3.3 GHz operation. These mixers come from aircraft radar and some communications systems. Several variations are starting to appear in surplus.

The "ortho mode" waveguide mixer (see Figure 4) takes a totally different approach by coupling the RF and L.O.

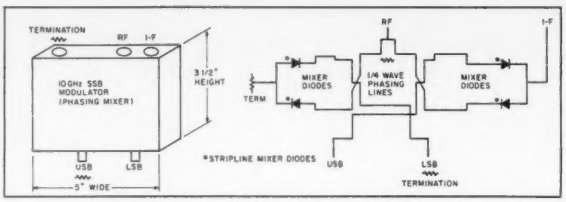

Figure 1. Surplus SSB modulator for 10 GHz.

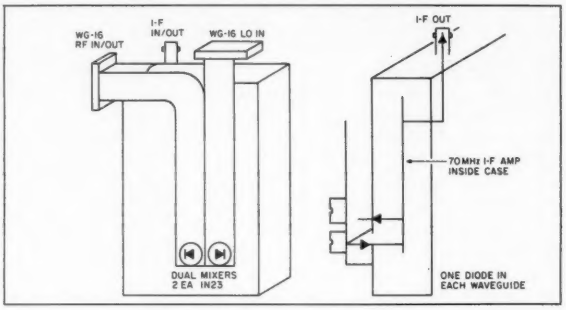

Figure 2. Waveguide mixer for 10 GHz.

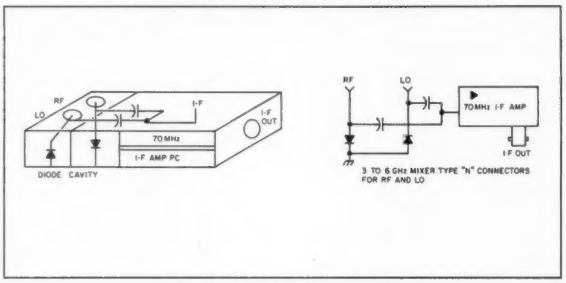

Figure 3. Mixer for 3–6 GHz range.

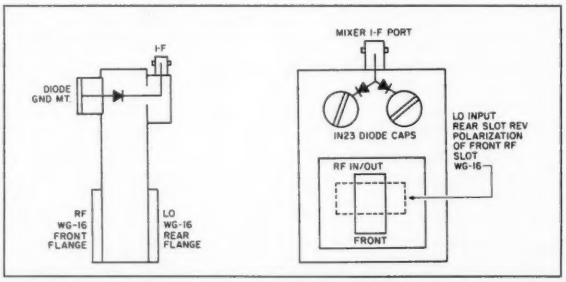

Figure 4. The ortho mode mixer 10 GHz (good for SSB 10 GHz), inexpensive in surplus, has good port isolation.

ports in a unique way. This mixer is waveguide orientated, with the RF port rotated 90 degrees from the L.O. port. This further isolates the ports. (Normal isolation between cross polarization is a minimum 30 dB loss). The IF amplifier could be bolted to the mixer, but usually the mixer is by itself. IF connections are made to both the detector diodes, one positive and the other reversed or negative. If you have one of these mixers, you can combine the detector diodes with two coupling capacitors to form the IF output. Don't forget to provide a DC return for the mixers. A small RFC will do the trick.

Now you might ask, "Why all the information on these mixers?" Well, they work and they're relatively inexpensive, costing about $10 to $20 each in surplus. You can use them to construct a high quality SSB or narrowband FM microwave converter. They may not be the latest state-of-the-art mixers, but they will work as well as the expensive types. Size is the only drawback.

Mixer Perspective

Of course there are several other types of mixers suitable for our microwave bands in addition to the types described. These can be single-balanced, double-balanced, quadrature IF, image rejection, rat race, and even triple balanced types. Mixers are rated by conversion loss and noise figure. Conversion loss is the ratio of RF input power compared to the IF output power. Noise figure, expressed in decibels, is the ratio of signal to noise. The lower the decibel value, the better the mixer will perform in receiving weak signals.

Listing 1.

FORMULA FOR GUIDE WAVELENGTH (FREE SPACE)

```
3  REM PROGRAM CALCULATES GUIDE WAVELENGTH
7  REM IN A WAVEGUIDE ENTER DIMENSION IN
8  REM INCHES EXAMPLE WG16=.9 INCHES
9  REM ENTER FREQUENCY IN MHZ
10 INPUT "FREQUENCY";F
20 INPUT "DIMENSION A";A
22 X=300000/F
24 Z=25.4 * A
30 B=2 * Z
40 C=X/B
50 D=C^2
60 E=SQR(1-D)
70 G=X/E
80 PRINT G
90 GOTO 10
```

Listing 1. Free space calculation for guide wavelength.

Listing 2.

SAME PROGRAM FOR GUIDE WAVELENGTH BUT CORRECTED FOR SEA LEVEL ATMOSPHERIC CONSIDERATIONS AND ADDED "ABS" STATEMENT TO CORRECT FOR SOME COMPUTERS' METHOD OF HANDLING NEGATIVE / LESS THAN ONE

```
2 REM CONSTANT CORRECTED FOR SEA LEVEL
3 REM AND STANDARD HUMIDITY (299780)
5 REM PROGRAM CALCULATES GUIDE WAVE
6 REM LENGTH IN FRACTIONAL INCHES
8 REM DIMENSION A=INSIDE WAVEGUIDE
9 REM EXAMPLE WG/16 = .9 INCH
10 INPUT "DIMENSION A";A
20 INPUT "FREQUENCY";F
22 X=299780/F
24 PRINT X

26 Z=25.4*A
30 B=2*Z
40 C=X/B
50 D=C^2
52 H=1-D
53 PRINT H
55 H=ABS(H)
60 E=SQR(H)
70 G=X/E
80 PRINT G
84 I=G/25.4
86 PRINT I
90 INPUT "DO YOU WANT MORE DATA";Z$
100 IF LEFT$ (Z$,1)="Y" THEN 20
110 END
```

Listing 2. Guide wavelength program corrected for sea level.

Listing 3.

PROGRAM FOR DIELECTRIC CONSTANT OF PRINTED CIRCUIT BOARD

```
2 REM THIS PROGRAM CALCULATES THE
4 REM DIELECTRIC CONSTANT OF DOUBLE
6 REM SIDED PC BOARD BY MEASURING THE
7 REM CAPACITANCE IN PF, AND MEASURING
8 REM THE SQUARE INCHES OF THE MATERIAL
10 INPUT "distance between plates";D
20 INPUT "measured capacitance";C
30 INPUT "square area in inches";A
40 X=.224*A
50 K=D*C/X
60 PRINT "dielectric constant";K
70 INPUT "DO YOU HAVE MORE DATA";Z$
80 IF LEFT$ (Z$,1)="Y" THEN 20
90 END
```

Listing 3. Dielectric constant calculation for PC boards.

Keep looking at flea markets and swap meets. Don't turn up your nose at some old grubby box with a waveguide mixer weighing half a pound and covered with spider webs. Check it out. I usually tell friends: If it's microwave and the price is low, buy it.

Listings 1–3

Larry K1LPS inspired the program listings in this column. In designing Gunn oscillators and detector mounts, he wondered, "Just how far from the back of the cavity do you space the diode or pick up in a transition?"

The dimension is a quarter of a wavelength, however the measurement is abraded by the fact that it travels differently in a waveguide than in free space. Therefore, it is spaced a "guide wavelength" (one-quarter guide wavelength, actually).

I worked the formulas out, but usually came up with different answers. In the process of doing my math I make "misteaks"! Therefore, I put the formulas in a basic program that can run on almost any computer. The programs are short and can be typed in quickly. See Listing 1 for the free space calculation for guide wavelength, and Listing 2 for a corrected formula for sea level/humidity corrections. This program also corrects for computers like the Radio Shack Model 100 that can't take the square root of a negative number.

The program in Listing 3 is for figuring the dielectric constant of a double-sided printed circuit board. All you have to do is measure the capacity of the PCB, figure how many square inches of material you have, and enter it into the program. After a few calculations, you can make a chart to take to flea markets to determine if you are looking at Teflon™ or Fiberglas™ material.

From the Mailbox

Curt WA6TIP asks about the mike transformer, capacitor C34, and the value of the meter movement used in the 30 MHz IF system in the article, "10 GHz Fun," in the April 1990 issue. Well, Curt, the mike transformer matches the impedance of your mike (assuming dynamic) low Z, to the high impedance of the mike circuit. Mine was about 2k to 50k, a surplus type. In the article, pins 2 and 3 of the mike circuit were erroneously reversed. Pin 2 should go to the decoupling network and feedback resistor, and pin 3 ties to the mike circuit. Sorry about that.

Alternatively, you could replace the transformer with an electret mike (99¢ at Radio Shack). Convert the circuit by tying one end of the electret mike to pin 3 and the other end to ground, and couple a 15k resistor at pin 3 to +DC. Capacitor C34 was left off the parts list; it's a 10 µF bypass, noncritical. The meter movement was a sensitive-type 25 microamps. You can use any type of meter up to about 200 microamps.

Next, a letter from Jeffry N0MAU. He wanted to determine just how expensive it is to get on the 2 or 3 GHz bands. I believe it would cost about a hundred dollars for a kit of parts along with some good scrounging. That's why I am pulling for 10 GHz operation. You can get 10 GHz equipment inexpensively by scrounging local alarm companies for microwave alarm units. Alarm companies are tossing out microwave units in favor of newer systems. That would make a simple system for 10 GHz cost effective. The total cost of a simple system could be less than $40 if you scrounge parts.

Gary KD6RF wants to know if the PC board for the 30 MHz IF amplifier is still available, and if the price has gone up. Well, everything is going up, especially gasoline, but my price remains the same. Cost is still $10 for the PC board with the TDA-7000 chip, and a few other parts to help you defray costs. (See "10 GHz Fun.") I try to keep all items available to assist project building, as I feel this is a very necessary ingredient to promote low cost projects for our UHF/VHF microwave frequencies.

New developments in my shack include working on several laser related projects, and I'm looking for a few parts, especially head-on photomultipliers to use in an optical receiver. Already built is a unique circuit for the receiver, which I'll cover in a future column. I've built a diode detector, but I want to try the photomultiplier tubes out next because they are more sensitive. I would appreciate any help or information on a source of these tubes.

I'll be glad to answer any questions related to our VHF/UHF microwave bands or similar topics. Please send an SASE for prompt reply. Chuck WB6IGP 73

UPDATES

10 GHz Fun

Chuck Houghton's article, "10 GHz Fun," appeared in the April 1990 issue of *73*. See his "Above and Beyond" column, page 59, in this present issue for corrections. He states that in the article, pins 2 and 3 of the mike circuit were erroneously reversed. Pin 2 should go to the decoupling network and feedback resistor, and pin 3 ties to the mike circuit. 73

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83-822	PL-259 Teflon, Amphenol	1.75
PL-259/ST	UHF Male Silver Teflon, USA	1.50
UG-175	Reducer for RG-58	.20
UG-176	Reducer for RG-59 & MINI 8	.20
UG-21B/U	N Male RG-8, 213, 214, large body	5.00
9913/PIN	N Male Pin for 9913, 9086, 8214 fits UG-21D/U & UG-21B/U N's	1.50
UG-21D/9913	N Male for RG-8 with 9913 Pin	3.95
UG-21B/9913	N Male for RG-8 with 9913 Pin	5.75
UG-146A/U	N Male to SO-239, Teflon USA	6.00
UG-83B/U	N Female to PL-259, Teflon USA	6.00

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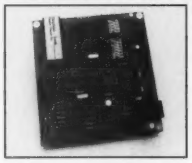

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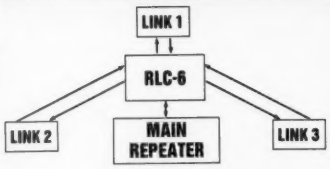

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Germany and Yemen

Germany: The ARRL Awards Committee has accepted the following recommendations of the DX Advisory Committee:

Effective October 3, 1990, the German Democratic Republic, Y2 through Y9, is deleted, because that country was absorbed by the Federal Republic of Germany on that date. Contacts with Y2 through Y9 stations on or after October 3, and contacts with DA through DL stations on or after September 17, 1973, will be credited as contacts with the Federal Republic of Germany.

The committee doesn't mention the former East German stations with callsigns in the DM series; however, the official allocation for the Federal Republic of Germany is DA through DR, not DA through DL.

Yemen: Effective May 22, 1990, the People's Democratic Republic of Yemen, 7O, and the Yemen Arab Republic, 4W, are deleted. In their place, a new country, Yemen, 7O, is added effective the same date. March 1, 1991, has been set as the earliest date for submission of cards for credit for the new Yemen listing. Please do not submit cards for credit prior to that date. Honor Roll members who have made contact with Yemen since May 22, 1990, will be able to update their credits during the month of March 1991, prior to publication of the next Honor Roll listing.

DXCC Processing Backlog

In late October 1990, the ARRL staff, faced with a large backlog in processing DXCC applications, organized a special effort to speed things up. ARRL Business Manager Barry Shelley temporarily took charge, applying what he'd learned in banking, where daily processing of numerous transactions is commonplace.

Other new assignments at ARRL headquarters also helped to reduce the backlog. By early November, applications received in June 1990 were being processed, a delay of approximately five months. As the new process gains momentum, the delay should be steadily reduced to an acceptable period.

"Islands On The Air" Award Program

Possibly one of the many good things about DXing is the chance to learn world geography. The Islands On The Air (IOTA) Award program goes one step further. It gives you a reason to learn about the world's islands, many of which would otherwise go virtually unnoticed.

Shortwave listener Geoff Watts created the IOTA Award program in the 1960s, when he began to wonder what DXers would do when they had worked all of the DXCC countries. For almost six months, Geoff spent two days each week surrounded by atlases and naval charts, listing, identifying, and grouping islands and archipelagos by continent.

The first IOTA contacts were credited on December 1, 1964, the day the *IOTA Directory* was first published. Today, this award program, consisting of 16 separate awards based on numbers of islands contacted and world location, is administered by Roger Balister G3KMA and the IOTA committee. You can obtain information about IOTA's award program and a copy of the island *Directory* from Roger Balister G3KMA, La Quinta, Mimbridge, Chobham, Woking, Surrey GU24 8AR, England. The price is US$4.00 or 7 IRCs in Europe; US$5.00 or 9 IRCs outside of Europe. 73

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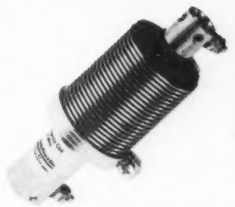

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KW-15		15	21.275
KW-17	NEW	17	18.118
KW-20		20	14.175
KW-30		30	10.125
KW-40		40	7.250
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3D2AA	via SM2BFJ	CV2V	via CX4CB	SV5A	via SV1AIH
4S7EF	effective Oct. 18 via N1HBF	CY9CF	via FP5DX	T30F	via OH6ZS
4U1ITU	1990 CQWW phone via OK3LZ		1990 *Callbook* address	T30JH	Box 299
4U1ITU	Oct. 20, 1990 op was KGYK	D68GA	via N6ZV		Ryde, NSW 2112
4U45UN	(4U1UN) via NA2K	D68VT	via K5VT		Australia
5W1JF	via WB6OKK	ED4CW	EA4CW, José Ricardo López	TA5KA	via HA0NNN
5W1JJ	via K6VNX		PO Box 28067	TP2CE	November 2–4:
5W1TD	via W6MKB		28080-Madrid, Spain		via F6FQK
5W1XD	via W6XD	ES2WX	PO Box 13	TY1DX	via IK6FHG
6D2X	via KD5GY		Viimsi 203006	TY2A	Box 40
6I2A	via XE2AQ		Estonia, USSR		I-61100 Pesaro, Italy
7Z1AB	1990 CQ WW phone only	FK8GJ	via F6CXJ	UH8EA	now via W5BWA
	via KN2N	FO0SSJ	via K8JRK	V47KP	via K2DOX
	Callbook address;	FO8AA	via N6VO	V47NS	via W9NSZ
	others now via WB2WOW		for North America	V63BD	via VE3JDO
8P9X	via K4FJ	FY5FP	via ON4ZD	V63DX	via JA7HMZ
9H8C	via PA0VAJ	GP6UW	via G3XTT	V73AZ	via KX6DC
9J2FR	via I2ZZU	HC2G	via HC2CG		*Callbook* address
9M6OO	via N2OO	HD1T	via W2KF	V85OM	via N2OO
9Y4H	via *Callbook* address	HX6DMX	via French bureau	VP2MEU	via K8UE
A35DM	via ON4QM	IJ8MAS	via IK8ISH	VP5VWB	via WD8RIH
A71CD	PO Box 80074	J37DX	via W8KKF	VP5VMA	via WD8LLD
	Al-Wakr, Qatar	J37V	via K8CV	W6TEX/CT3	via W6TEX
AY9F	via LU9FHF	JY9SR	Ray Shankweiler, Box 354	XX9KA	via KC9V
CN2CW	via F2CW		Amman, Jordan	XU8DX	via JA1NUT
CN2JO	via F1MJ	K9EL/VS6	via K9EL		use oversize
	op was F6ATQ	KH0AM	via JE1CKA		envelope
CN8YP	via F6FYP	L8H	via LU4HH	YJ1A	via OH3GZ
CN8VV	via F6EEM	LP3F	via LU6FAZ	YM5KA	via HA0NNN
CQ9M	via G3PFS	LZ1V	via LZ1KZM	ZS9/W6KG	same as C9QL
CR2UW	via CT4UW	PY1QN/PQ8	via PY1QN	ZS9Z	via ZS6BCR
CT3EU	via G3PFS	R3R	via RA3RQT	ZS9Z/ZS1	via OH2BH

QRP

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Michael Bryce WB8VGE
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A Station T/R Controller

Last month I mentioned a project every QRPer should have in the shack: a station T/R controller. This month we'll take a look at what is needed to accomplish this task.

When I started working on the station controller, I had to design it to work in anyone's station; to be able to mate with and control the vast amount of receivers on the market, without knowing the requirements for muting or antenna changeover. This controller uses relay switching to control the external devices. I chose relays for several simple reasons: They're cheap, easy to come by, and they totally isolate the logic from the external device. I've included a parts list for all major components, with Radio Shack part numbers. Of course, you don't have to get your parts from Radio Shack; junk box parts will do quite nicely. In fact, the board layout is very flexible. You can use either radial or axial capacitors for the two large electrolytic capacitors listed.

To make things even better, I've joined forces with FAR Circuits to produce circuit boards for this column (see the parts list for address).

The T/R controller should be looked at as four different circuits. This will make troubleshooting easier, should the need arise. The four circuits consist of the following: sidetone generator, audio amplifier, delay switching and keying, and power conditioning. To better understand how the T/R controller works, a short description might help. We'll start with the power conditioning part of the controller.

Parts List

1	741 op amp	RS 276-007
1	LM386 amplifier	RS 276-1731
4	2N2222	or RS 276-2009
1	2N3905	or RS 276-2023
4	1N4001	RS 276-1101
1	1N914	RS 276-1122
1	5k PC trimmer	RS 271-217
1	100k PC trimmer	RS 271-220
	or 100k panel pot	RS 271-092
1	10k PC trimmer	RS 271-218
	or 10k panel pot	RS 271-1721
1	4700 µF cap	RS 272-1022
1	1000 µF cap	RS 272-958
	or 1000 µF	RS 272-1047
1	470 µF	RS 272-1030
	or use 470 µF	RS 272-1018
1	0.1 cap	RS 272-135
1	47 µF	RS 272-1027
1	10 µF	RS 272-1025
2	PC mount relays	RS 275-219
1	reed relay	RS 275-233
1	metal enclosure	RS 270-272

Miscellaneous parts include resistors, small capacitors, PC board, IC sockets, connectors, knobs, LEDs, wire, antenna relay (a good choice would be RS 275-218), and other odds and ends.

A blank PC board is available for $6.50 + $1.50 postage/handling from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

Power Conditioning Circuit

Being solar powered, my station is a bit different from the usual ham shack. A large battery bank supplies power to the shack. Because of the nature of this setup, I have to decouple any 12-volt device from the 12-volt bus. In the T/R controller, the decoupling is in the form of a large electrolytic capacitor.

To provide reverse voltage protection to the T/R controller, a small 1N4001 diode is in series with the supply line. You might worry about the diode surviving the inrush of current to charge the capacitor, but this shouldn't be a problem. If you can't sleep at night thinking about it, use a 3-amp diode in place of the 1N4001.

If you connect up the T/R controller backwards, nothing will happen, and there will be no damage. After this diode comes the 4700 µF capacitor. You may not need that much capacitance. In fact, one of the T/R controllers I plan on using in a transceiver has only 2200 µF of capacitance. Use what you need to keep critters off of the +12 volt bus, but don't lose any sleep if you can't find the exact amount listed here. The value is not critical. I supply operating power for the T/R controller from my +12 volt power bus.

As a second thought, you can use a wall transformer to power the T/R controller, as long as the unit can supply +12 volts with at least 500 mA. The large 4700 µF cap will smooth out even the nastiest wall transformer power supply. You may even be able to get by with an AC powered wall transformer, as the diode will rectify this and the 4700 µF cap will then act as a large filter cap. This is not the best route to take, but it *should* work. A 470-ohm resistor and LED are included to let you know the T/R controller has power applied to it.

Four LEDs keep you informed on what is happening with the T/R controller. There is one each for "power on," CW keying, delay, and "audio on." I used TP1 LEDs in my prototypes. These are very bright and look nice in the case I chose to use.

The Sidetone Generator

I used a 741 op amp to generate the tone, with a PC mounted trimmer to adjust the pitch. You can adjust it to your liking. This tone generator is turned on and off to follow the keying. I did not want to keep the tone generator running all the time, since this could cause trouble if the high gain audio stages of a direct conversion receiver were to pick it up. The result would be a constant tone in the receiver. The tone generator is keyed on by applying +12 volts to the sidetone input.

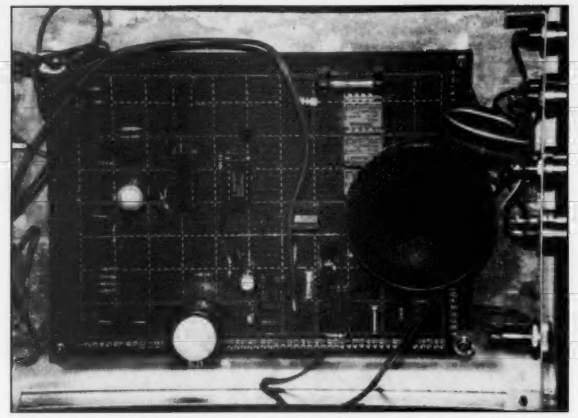


Photo A. Inside of the prototype of the T/R controller. Notice the four relays; one is hidden under the speaker. Also, note the three extra ICs for the keying delay circuit. This was not included in the final circuit.

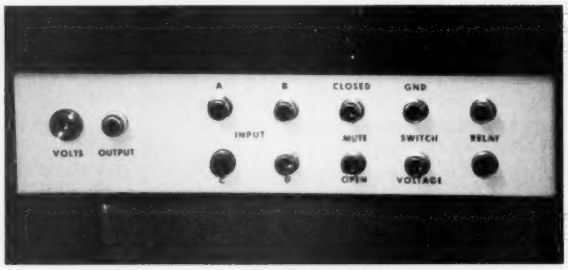


Photo B. Rear view of the T/R controller in a Radio Shack chassis.

The Audio Amplifier

The audio amplifier takes the low-level sidetone and provides speaker level audio. This is a classic design using an LM386 audio amplifier chip. Notice the second 1000 µF capacitor near the LM386. Don't forget to include this capacitor; it keeps the LM386 happy.

You may either use the PC mounted trimmer to adjust the volume of the sidetone, or a panel mounted control, as I did. If you decide to panel-mount the volume control, just run the wires to the PC holes used for the trimmer. Use small shielded cable. A set of holes is included on the board to turn off the audio amplifier. If you want to keep the audio on all the time, jumper these pads together and just turn the volume down. I added this feature just in case your keyer has a built-in sidetone.

Delay Keying

Though the final product is simple, cheap, and efficient, I had to do some real soul searching on the design of the delay keying. In the photographs of the prototype, you'll notice several extra IC chips. These were used to add a 25 ms delay to the transmitter. The idea was to turn the relays on, let the contacts stop bouncing, and then turn the transmitter on. The prototype worked quite well, but I was also getting reports of missed first characters. By the time I fixed that problem, I had practically no delay left, so why include it?

The delay circuit is fast (this depends on the type of relay used) and extremely easy to build. When the key is closed, transistor Q2 is turned on. This supplies +12 volts for several circuits. First, if you connect the sidetone out to sidetone in, you provide keying voltage for the sidetone generator. Second, transistor Q3 is turned on. This grounds the reed relay, keying the transmitter. An LED is also keyed along with the relay.

While all this is happening, +12 volts is applied to the 47 µF capacitor via the 1N914 diode. This turns on Q4 and Q5, activating the two on-board relays. Notice that the contacts of each of these relays are not connected in any particular way. This is one of the benefits of the T/R controller: complete versatility. One relay will control an external antenna relay and the other will mute the receiver. The contacts of both relays are rated at 5 amps. You can use one of the relays, if need be, to control a 110 volt AC antenna coaxial relay. However, if you do this, use EXTREME CAUTION since you'll be exposing yourself to the full line voltage on the back of the board.

You might also want to move the relays off the board. This might be the case if you can't find, or don't want to spend, the money for Radio Shack relays. If this is so, connect the coils to the proper pad of the T/R board. Mount the relay and use the contacts to your liking. A 4PDT relay can be used with no trouble if you don't mind the rat's nest of wires coming from the contacts.

In small QRP projects, you might even be able to get away with running the antenna through the on-board relay. There is minimum RF bypassing

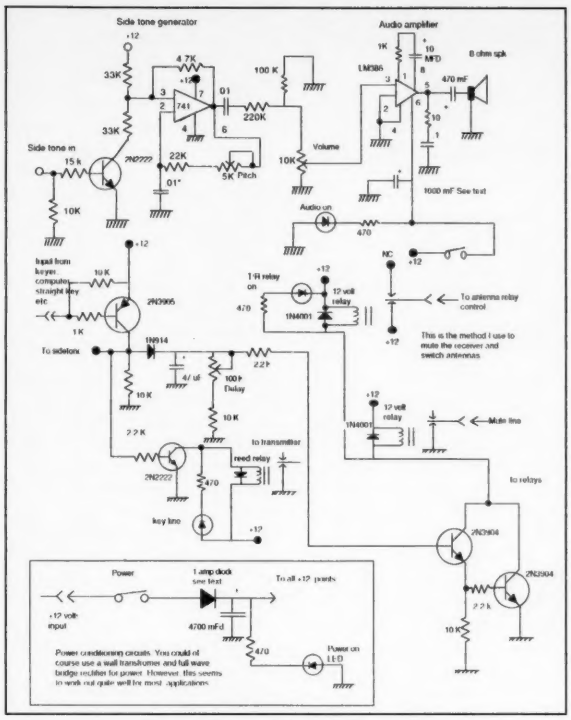

Side tone generator
Audio amplifier
Side tone in
Volume
Pitch
Audio on
1000 mF See text
Input from keyer, computer, straight key etc.
To sidetone
To antenna relay control
This is the method I use to mute the receiver and switch antennas.
12 volt relay
Mute line
to transmitter
reed relay
key line
to relays
Power
1 amp diode see text
To all +12 points
+12 volt input
4700 mFd
Power on LED
Power conditioning circuits. You could of course use a wall transformer and full wave bridge rectifier for power. However, this seems to work out quite well for most applications.

Figure 1. Schematic for the T/R controller.

on the board. You might have to add some 0.01 and 100 pF caps on the input lines to keep RF from getting into the circuit.

Start to Finish

The T/R controller is best built in sections. The first place to start is with the power conditioning components. Stuff the components for the sidetone and audio amplifier second. After checking over your work, connect an 8-ohm speaker to the output terminals. Set both the pitch control and the volume control to mid-range. Apply power to the controller. *Make sure the audio power is turned on via the PC pads.*

If you installed the power-on LED, it should be on. Use a clip lead and apply +12 volts (get this from the + side of the 4700 µF capacitor) to the sidetone in the terminal. If all is working, you'll hear a tone from the speaker. Remove power from the board. Finish stuffing the rest of the board.

Set the delay control to mid-range. Apply power to the board. Ground the key input terminal. The relays should pull in and the T/R LED should be on. Remove the clip lead from the key-in terminal. After a short delay (determined by the setting of the delay control), the relays should drop out and the LED should go dark. Key the terminal on and off with the clip lead. This should make the reed relay also turn on and off, following the keying from the terminal. The CW LED should also follow the keying. Use a small wire and connect the sidetone out to sidetone in terminals together. Again, ground the key input. The sidetone should sound, relays pull in, and reed relay follow the keying.

If you connect your keyer, straight key, computer or whatever to the key in the terminal, grounding this point will turn on the T/R controller. I used a six-position switch to select six different inputs from the front panel on my T/R controller. Not only do you get total automatic T/R control, but the added convenience of keyer selection, too.

Antenna Connection

Perhaps the most difficult part of building the T/R controller will be deciding how to connect it up to the rest of the equipment. Primary consideration will be in the antenna switching. I use a second relay (from the junk box; if purchased, a good choice would be a Radio Shack 275-218) in a small aluminum box. The box is mounted in an out-of-the-way place with a control cable connecting the antenna switching relay to the T/R controller via a two-conductor cable.

This box contains SO-239 connectors and RCA jacks, so I can use both or either type of connector on the end of the cables from the antenna, receiver, and transmitter. The relay contacts switch from receiver to transmitter. The control voltage is +12, supplied from the T/R controller. One of the on-board relay supplies switched +12 volts to the antenna control relay.

The second on-board relay mutes the receiver. My receiver needed the mute line isolated from ground to receive. To mute the receiver, you mute the line to ground. Now you can see why the contacts of the relay have been left uncommitted. I use RCA jacks on the back of the T/R controller, and just pick the ones that I need.

Well, that's about all the space this month. Now that you have a T/R controller, perhaps next month we'll have something to control. Don't unplug the soldering iron just yet.

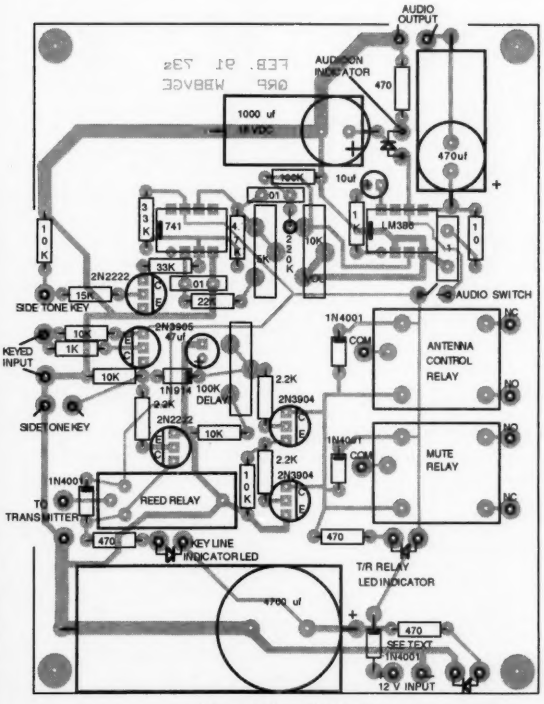


Figure 2. Parts placement.

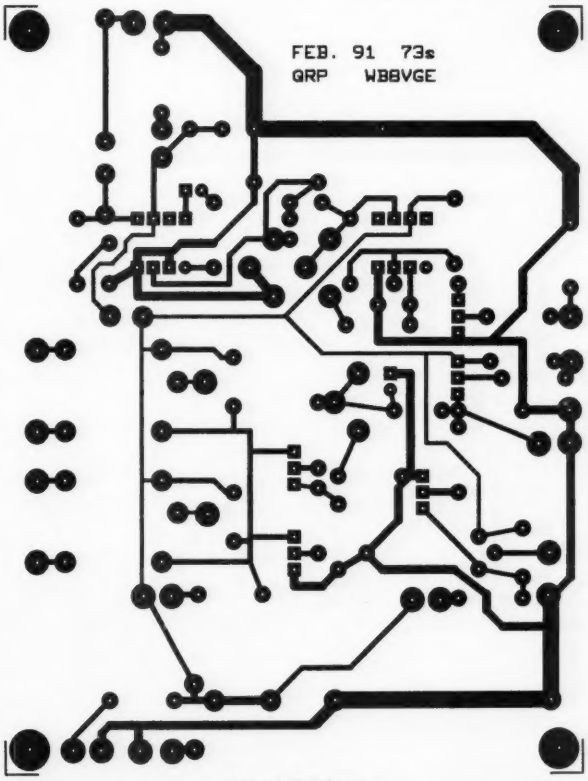


Figure 3. Foil diagram.

Number 20 on your Feedback card

NEW PRODUCTS

Compiled by Hope Currier

AEA

The PC-Pakratt II has finally arrived! This program replaces the popular PC-Pakratt program for IBM compatible computers. It is a powerful program that takes advantage of AEA's exclusive Host Mode, and offers full Host Mode support for the latest PK-232 command set. PC-Pakratt II works with IBM AT & XT compatible computers, with or without a mouse. The program includes the latest version of AEA's PK-FAX program, offers a full QSO logging feature and a DOS gateway, and it can save and restore all 18K of Pak-Mail messages to disk. Its other features include user-friendly help screens, macro facility, complete parameter screens, and quick access to the user's word processor. PC-Pakratt II very closely resembles the original program, so current users should find it relatively quick and easy to make the switch.

If you already own the original PC-Pakratt, regardless of when you purchased it, you are eligible for a $40 discount off the suggested retail price of $70 for the new program. For more information contact *Advanced Electronic Applications, Inc., P.O. Box C2160, Bldg. O & P—2006 196th SW, Lynwood WA 98036-0918; (206) 775–7373, Upgrade Hot Line: (206) 774–1722.* Or Circle Reader Service No. 201.

ASHTON ITC

Ashton ITC has announced a new communications software product called SCORPIO (Shortwave Computer Operated Radio Plus Input/Output). Designed for the sophisticated shortwave listener and monitor, SCORPIO breaks new ground by combining intelligent scanning, based on a flexible database search, with simultaneous automated digital signal decoding and data capture. It can be interfaced with ICOM and Kenwood computer-ready receivers, plus RS-232 all mode terminal units such as those manufactured by AEA, Kantronics, MFJ, Tonno and others.

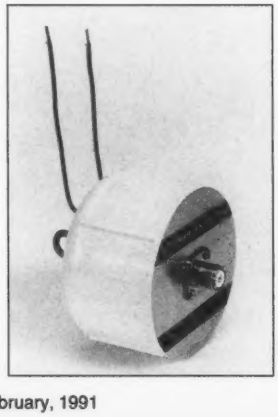
SCORPIO makes it easy to build databases (log files) which can include a received station's identification, location, frequency, mode, time of operation, agency or type of service, signal level, date heard and any pertinent remarks. These databases may contain thousands of entries and may be sorted and searched by any category. An *AutoLog* function can even record "hits" to disk during a scan, and convert the resultant file to a database.

SCORPIO includes a comprehensive User's Guide and a sample database containing 100 of the most popular HF utility and SW broadcast frequencies. It sells for $90. Contact *Ashton ITC, P.O. Box 830, Dandridge TN 37725; (615) 397–0742.* Or circle Reader Service No. 205.

PALOMAR ENGINEERS

Palomar Engineers has a new addition to their high power balun line: the Model SB-4. This balun, 4" in diameter x 4" high, is specially designed to operate at high SWR so it can be used in antenna tuners, at the feedpoint of multiband dipoles, and to convert from ladder line to coaxial line outside the hamshack. It has a 1:4 impedance ratio and operates efficiently from 1.8 to 30 MHz. Power capability is 2000 watts continuous power at up to 10:1 SWR. The balun is weatherproof, epoxy-filled and sealed, with Teflon™-insulated SO-239 connector and wire leads for the antenna or ladder line. A stainless eyebolt is provided for mounting.

The Model SB-4 is priced at $75. Contact *Palomar Engineers, P.O. Box 455, Escondido CA 92033; (619) 747–3343, FAX (619) 747–3346.* Or circle Reader Service No. 202.



J•COMM

J•Comm has introduced a new audio filter for use by amateur radio operators and SWLs, the MagicNotch™. This is an automatic audio notch filter designed to instantly remove heterodyne QRM from SSB reception. It effectively reduces interference caused by negligent operators tuning on or near the frequency, CW signals,or other carriers. The MagicNotch filter is also very useful in reducing the effects of computer generated RFI, which is becoming an important source of heterodynes in the ham shack today. No tuning of the filter is required. When interference of a constant frequency is detected by the control circuitry, the internal switched capacitor active filter (SCAF) is automatically tuned to that frequency, effectively reducing the interference by up to 40 dB. The filter will continue to track any variation in the frequency of the interference until it disappears. The width of the notch is extremely narrow so there is no noticeable degradation in the quality of normal speech signals. The filter activates in less than one second. In many cases, the operator may not even be aware that a carrier has appeared. Operation of the filter is indicated by a two color LED which turns red when an interfering signal is locked in.

No modifications to existing equipment are necessary. The filter operates on the audio output from the receiver as obtained from the external speaker output. The built-in 2 watt amplifier is sufficient to drive any 8 ohm speaker. The filter is powered by 10–14 volts DC, which is usually obtained from the accessory connector of the rig. The compact 5.5" x 3" x 1.5" unit is housed in a gray and blue aluminum enclosure.

The introductory price is $100, plus $5 S&H. Contact your nearest dealer, or *J•COMM, P.O. Box 194, Ben Lomond CA 95005-0194; (408) 336–3503.* Or circle Reader Service No. 203.

AMERICAN DESIGN COMPONENTS

A new 1991 catalog of electronic, electromechanical and computer-related parts and components at below factory outlet prices is now available from American Design Components. This 48-page, fully-illustrated catalog is chock full of components and peripherals. It features integrated circuits, switches and connectors, power supplies, rechargeable batteries, fans, blowers, and more. Easy indexed for shopping, the catalog also features a large assortment of computer products such as monitors, disk drives, add-on boards, mice, modems, and unbelievably low-priced computer systems. All material is available for "off-the-shelf" delivery.

Contact *American Design Components, 815 Fairview Avenue, Fairview NJ 07022; (800) 776–3700, (201) 941–5000.* Or circle Reader Service No. 204.

PASTERNAK ENTERPRISES

Pasternak Enterprises catalog #1991 features a complete line of amplifiers, molded breakouts, coaxial cable, coaxial switches, cutting tools, stripping tools, coaxial connectors, coaxial adapters, coaxial detectors, coaxial attenuators, coaxial terminations, patch cords, programmable attenuators, push-button attenuators, coaxial cable assemblies, waveguide adapters, twinaxial adapters and connectors. In addition, this catalog contains many new cable assemblies that utilize 3.5mm, 7mm, HN, N, SMA, SMB, SMC, BNC, TNC, UHF, SC, SHV and MHV connectors. It includes pricing on more than 2,500 standard catalog items, as well as technical information.

For more information contact *Pasternak Enterprises, P.O. Box 16759, Irvine CA 92713-6759; (714) 261–1920, FAX (714) 261–7451.* Or circle Reader Service No. 206.

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Jim Bail KA1TGA, 73 Magazine Review Jan '90

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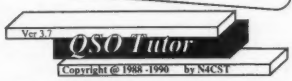

* Entry class license (Novice) requires passing a theory exam covered in this program and copying morse code at 5 words per minute. FCC application forms are available on request, free of charge. Tests are administered by local hams, call for more details.

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Consult your local dealer or send directly for further product information.

SPECIFICATIONS

Model	Freq. MHz	Power Input	Power Output	Preamp NF-dB	Preamp Gain-dB	DC +Vdc	Power A	RF Conn.
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1450G	144-148	10	400	.6	15	13.6	54	UHF
1452G	144-148	25	400	.6	15	13.6	50	UHF
2252G	220-225	25	220	.7	14	13.6	36	UHF
4450G	420-450	10	175	1.1	12	13.6	34	N
4452G	420-450	25	175	1.1	12	13.6	29	N

Models also available without GaAs FET preamp (delete G suffix on model #). All units cover full amateur band – specify 10 MHz bandwidth for 420-450 MHz amplifier. Continuous duty repeater amps also available.

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CIRCLE 232 ON READER SERVICE CARD

ASK KABOOM

The Tech Answer Man

Michael J. Geier KB1UM
% 73 Amateur Radio Today
WGE Center
Forest Road
Hancock NH 03449

Why Rigs Sound the Way They Do

One favorite topic you can hear on any ham band at just about any hour is the good ol' "How's my rig sound?" Sometimes it seems like an obsession, surpassed only by the local weather and QTH.

Why are we so concerned about how our radios sound? Well, for one thing, it comes from the tradition of homebrewing. Remember, there was a time, not all that long ago, when we hams built our own stations. Not only was the transmitted audio quality a point of pride, it was also a legal concern. Bandwidth limits had to be observed, and you couldn't count on Kenwood to ensure you weren't breaking the law because of excessive high frequency response or distortion.

Today, of course, home-built stations are rare, at least on this side of the now-rusty iron curtain. Yet we continue to discuss and adjust our audio, trying different mikes and level settings, all the while striving vainly for that "perfect" sound. What we often overlook, however, is that the sound of a rig is dependent upon far more than its microphone, and in fact may be inherent in the radio itself. More than anything else, the modulation mode (AM, SSB, FM) and the method used to achieve it determine the limits of audio quality. But let's start where the audio signal starts: the mike.

Speak Into the Transducer, Sonny

Yes, your microphone's characteristics do have a great influence on your audio.

There are four types of mikes in common use:

Crystal mikes depend on the piezoelectric effect to generate a voltage by flexing a crystal. They have a high impedance (50k ohms or more) and are mostly found with older tube gear. The mikes are somewhat tinny and harsh sounding. Sometimes, the effect can result in excellent "punch" on SSB. Unfortunately, crystal mikes also have a limited life, and the old one you got with that hamfest special may be shot. The symptom of a bad one is *extremely* tinny or distorted audio, bordering on the unintelligible. Many an hour has been lost fruitlessly tracing signals through perfectly good audio stages when the real problem was a bad crystal mike.

Ceramic mikes are similar to the crystal units except that they are less likely to fail with age, and they are a bit less tinny. Although not in common use, they can be great with tube gear, and even used successfully with solid-state gear, as long as there's a matching transformer between the mike and the rig. Some exotic headset-type mikes use ceramic elements to great advantage.

Dynamic mikes are built somewhat like small speakers. They have permanent magnets and voice coils. The difference is that they are used in the generator mode; the output from the voice coil results from the sound waves striking the diaphragm.

These mikes are inherently low-impedance, and produce far less output than their piezoelectric cousins. Some have small matching transformers in their cabinets for high-impedance use. Dynamic mikes are pretty rugged, and rarely ever fail.

Their sound is quite a bit less tinny than that from the crystal or ceramic types, but it still has a rising frequency characteristic. That is, the voltage output of the mike rises with the audio frequency. Until a few years ago, mobile HF rigs and most VHF units came equipped with dynamic mikes.

Electret condenser mikes have the smoothest frequency response of all. They use a permanently-charged diaphragm (the "electret") between two electrodes, in a capacitor-like arrangement. The minute changes in capacitance which result from the diaphragm's flexing can be detected with an FET preamp and converted into an audio signal. In fact, most condenser mikes have the preamps built right into their tiny cases! Even with the circuitry, they are the smallest mikes around. Because their diaphragms don't have to push against anything, they don't need much mass. (That's also the reason for the great frequency response.)

Because of their flat frequency response, these mikes sound very natural, and high-precision versions are often used in studio recording. Natural voice quality is not the same thing as maximum intelligibility, though. In fact, a somewhat tinny mike gets through HF QRM better than a natural, smooth condenser mike. Despite this, most new rigs come with condenser mikes because they are small and inexpensive. With some equalization, though, they can sound fine on the air. Some radios incorporate the EQ into their speech amps.

By the way, all condenser mikes require DC power to run the preamps. Some have small batteries, but many are supplied with power from the rig, often on the same wire carrying the audio.

XMIT Modulation

Different modulation modes sound different. We all know that, but why is it so?

In theory, modulation is modulation, and it shouldn't make any difference what kind you use, as long as the received signal levels are adequate to prevent noise on the demodulated output. But you've heard it said that FM sounds the best, AM is great, and SSB is the worst. Is this true? Well, yes. Also, no.

FM does sound great. Most FM rigs, including HTs, are supplied with condenser mikes, so they start with natural voice quality. FM modulators and demodulators can be made very linear, which means low distortion. Also, the inherent noise-canceling effect of FM makes it seem especially clean, and the punch of a tinny mike is not needed. (In fact, excessive high frequency response makes a noisy, weak FM signal even worse, since it dilutes the tiny signal energy across a wider bandwidth.)

Finally, the IF bandwidth in FM receivers is quite a bit wider than the transmitter's deviation bandwidth, and unlike AM and SSB, it is not directly related to high frequency response. As a result, the receiver's selectivity filtering does not degrade the audio. Altogether, there's not much to interfere with the quality of FM, at least under local conditions. (Multipath and fading distortions make FM a dicey proposition for HF, although it is still fun.) If you were allowed 15 kHz audio bandwidth and wider deviation, you could sound just like your local rock and roll station.

AM. Ask any AMer and he will tell you that AM sounds much better than SSB. Is this true? Yup, but it doesn't have to be. Recently, I had the opportunity to play with the new Kenwood TS-950S HF rig, which has the facility to allow receiver filter selection independent of mode. I tuned an SSB signal in, and it sounded normal. Then I *removed* the SSB filter, and wow, it sounded exactly like AM—much crisper and brighter and altogether more pleasant. At last I could confirm what I'd always suspected: The deficiency seemingly inherent in SSB is actually caused by the sideband filter. (More on this later.)

The AM mode is simple and easy to do. In order to avoid having to make all the transmitter stages linear, though, modulation is usually accomplished right at the finals, by means of feeding their DC power through a transformer and pumping audio into the other side. The power fluctuates, and so does the output power, and there you have it—AM.

Of course there is always some audio phase distortion with a transformer, but it is negligible by voice communications standards. And without a sideband filter, the high-frequency rolloff can be rather gradual, resulting in considerably more than 3 kHz audio bandwidth. It's illegal, but it sounds real nice. So, AM is pretty darned good. But then, the amount of received noise is usually greater than with FM, so it sounds a little less clean.

And then there's selective fading, when one sideband fades more than the other, causing horrendous distortion. AM is especially prone to this kind of problem, because it includes and demodulates both sidebands. You can avoid it by clipping off one sideband, but then you may as well just go to SSB, because the clipping filter will make it sound the same.

SSB—is it bad? No, not at all. It is far and away the most power-efficient mode, and the audio is adequate for our normal uses. But it does sound a bit odd, even when the signal is precisely tuned in. To me, it sounds constricted. Of course, the filtering does cut the high frequencies off rather steeply at 3 kHz, which is required by law anyway. (Are you listening, AMers?) But it's more than that.

It appears to come from the resonance of the sideband filter. Any such steep filter will ring a little bit, and in some rigs you can hear it by tuning in background noise with no signal. If you listen carefully, you can discern a definite pitch to the noise, and this pitch is the resonance of the filter. Switch to AM and the note will be gone.

Remember that the sideband filter is used both in transmit and receive, so its effects are doubled. Is there another way? Yes, there is, and it is actually older than the way we do it now. Early sideband rigs used a technique called "phasing" to generate and receive SSB. In this method, transmit and receive signals at the IF level were split 90 degrees out of phase and combined in a special sort of mixer to cancel one sideband. It worked fine, but it was tricky to align and required lots of components.

Also, the phase relationships had to remain constant over the required bandwidth, or insufficient alternate sideband suppression and/or distortion could result. The great part of the scheme was that there was no sideband filter. At the time, the prime considerations were cost and availability—the ordinary parts were cheaper and easier to get than a good steep filter. What no one even realized then was that the technique held the promise of sounding better than a filter. Unfortunately, phasing rigs have disappeared as good, inexpensive filters have dominated the scene.

Is it too late for phasing? Maybe not. With today's technology, good and stable phasing circuitry should be simple to accomplish. Then, the IF filtering could be better tailored to avoid that tight, almost-ringing sound associated with SSB.

SSB Filter Adjustment

If your LSB and USB don't sound the same, your rig may need adjustment. They should have approximately the same tonal balance. An easy way to check is to let the rig warm up for about 15 minutes and then tune to where there is only band noise and no signal. Switch between the two sidebands and note the sound. They are not likely to be exactly the same because the two skirts of the sideband filter are never perfectly symmetrical. If the two sound *very* different, one or both may need adjustment.

Check the service manual for the carrier oscillator adjustments. These determine the exact frequency of the signal sent through the filter, and there is one for each sideband. Turning them will vary the audio response from tinny to bassy.

Incorrect adjustment can result in poor adjacent sideband suppression on both transmit and receive, so it is important to set them carefully. The manual should detail the correct procedure.

Well, that's about it. See you all next month. 73

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Baltimore MD 21208

CoCo Packet

Here in Maryland, February is the month with the reputation of blessing us with the most snow of the winter. So, as I sit here looking at my beautiful doublet antenna that took me so long to get up, as it now lies frozen on the ground, let's have a look at what interests you.

Michael Simmons WB9CWE of Charleston, Illinois, relates being an avid reader of "RTTY Loop" who has a special interest in the Tandy Color Computer. He states that to his chagrin, he has noticed a painful lack of packet software for the CoCo. He is wondering if there is any source, commercial or public domain, for packet software for this computer.

Well, Michael, my search for packet software reaches back many years, and I will say up front that I have often been as frustrated as you are. Several years ago, noticing that some of the original work on digital modes was done on Motorola (6800 and offspring) microprocessors, I wrote to several of the pioneers, asking them if software applicable to the masses would be in the offing. To a man, they responded, "No."

It seems that, all things considered, most of the applications for general purpose (not dedicated) microcomputers were just not suited to packet or AMTOR as configured, usually because of hardware constraints. This is not to say that someone, somewhere, did not write a program to put the 6809 (the CoCo's CPU) onto packet; it's just that no one told me about it.

As it sits now, the best bet for packet is to use your computer as a powerful terminal, with one of the many terminal programs, and allow a dedicated microprocessor in a box, a packet terminal, to do the hard part. That way, you can have the best of both worlds.

Oh, yes, one other point Michael mentioned in his letter. He asked if it were possible to convince ham radio software writers to give some serious attention to writing communications software for the CoCo. Michael notes that this computer has evolved into a rather sophisticated machine with full features, making the lack of support by the various commercial software publishers very puzzling.

Puzzling? Not if you consider the size of the installed base of computers among radio amateurs. Again, I queried some of the software houses, and that is exactly what I heard. Yes, the CoCo is a fine machine, but the fact remains that there are more C-64s and PC clones in ham shacks than CoCo's. There are several public domain or shareware programs, but, as you know, essentially no commercial ones. A company just cannot afford the development and marketing costs of a program that may receive only limited support from the community.

Hope the information helps. Who knows, maybe one of our readers will roll up his sleeves and write that program!

Copying and Receiving CW

Norm Boles WJ5Z of Las Cruces, New Mexico, is particularly interested in copying CW on his computer. Again, Norm, I have looked and found nothing. There are several CW practice programs around, and in fact, such a program is relatively easy to write in BASIC. Yes, if there is a demand I will print one here, but only if more than one of you asks for it.

Receiving CW is another matter. I agree that the CoCo is well-suited to the task, but no one has written the program—yet! If I hear something, you can be sure I'll pass it along.

The Mighty Mite

From the newest to one of the oldest—machines, that is—I have another letter here from Bob Schaumleffel WA2IKS, of Olean, New York, who speaks to my recollection of the Mighty Mite printer. Bob seconds the comment that this machine, if you can find one, is a beast to align but a workhorse once it is.

He purchased one about six years ago, complete with manuals (now that's a find), went through the alignment procedures, and found that if an adjustment was off a few thousandths of an inch, the little feller wouldn't work properly. He finally got it to perk along, and it is still in use today as one of his hard copy machines.

Bob also feels that if you plan to get a Mite working, it's not a bad idea to pick up a junker at a hamfest. Parts are hard to come by and any source wouldn't hurt! Thanks for the letter, Bob. Notes from youngsters like you keep us all hopping. And thanks for the stamp on the letter. It's been quite a few years since I've seen the 5 cent amateur radio stamp. That I'm old enough to have some put away, and remember when 5 cents was first class postage, is frightening enough!

Solder Sniffer Award

The RTTY Loop 1991 Solder Sniffer award candidate this month is Rob Zahora of Burlington, Massachusetts. Rob writes that he has finished the TU-1000, published in the June 1985 issue of *73*. Now, as soon as he gets a Baudot to ASCII conversion board, he should be in business. Hey Rob, please let us all know how things work out.

PK-232 Quirk

A cautionary note arrived in the mail from Bill Weatherford WA0NDF/TU4CQ, Cote d'Ivoire. Bill is using the AEA PK-232 with his Leading Edge Model D computer, and a friend of his is also using a PK-232 with an Apple II+. Both of them are quite pleased with the PK-232, but noted an interesting quirk.

Like many "boxes" which come into the shack these days, the PK-232 does not come with a power supply. Bill points out that the manual for this terminal calls for 12 volts DC at 1 ampere on one page, and at 750 mA on another. He found that if you run it at a tad less than 750 mA, you get all sorts of weird results. To stay on the safe side, be sure to use a power supply that can supply the full ampere. A marginal supply just won't do here. Thanks for the tip, Bill.

Problem of the Month

This one comes from Leslie Bruce W0OX (ex-W9BSR/W7KMD/W0EHX/K5AXW) of Boulder, Colorado. Leslie states that after many years of Model 14s, 19s, 28s, 33s, and 35s, he is now all computerized, and he hopes to obtain hard copy from his computer printer while using the computer on RTTY.

With a C-64, Hamtext cartridge, a Flesher TU-170, and a Blue Chip printer, Leslie wonders if there is a way that he can print on the printer both the transmitted and received data while using the split screen display of Hamtext. I don't know, but if the manual does not say so, I will guess that you can't. There are enough others out there with similar setups, so if it's possible, hopefully I will hear about it soon enough. If so, I'll pass it along here in "RTTY Loop."

On another note, Leslie wonders what his Blue Chip printer looks like to other programs. With printer drivers like Epson, Gemini, Panasonic, Silver Reed, Okidata, etc., there is no mention of Blue Chip. Well, to the bast of my knowledge, the Blue Chip is one of a series of printers which emulates the Epson MX-80/FX-80 standards. I would call it an Epson, and hope for the best.

Good luck, and I hope to hear from you again. I'm glad the years have not blunted your initiative in this crazy hobby of ours.

Get in Touch

As always, I remain available to your thoughts or such via mail, at the above address, or on CompuServe (ppn 75036,2501) or Delphi (username MARCWA3AJR). I love hearing from you, and you never know when your obscure question will end up here in print for everyone to see!

Next month, don't miss *73* as "RTTY Loop" Marches along. (Sorry... I couldn't help myself!) 73

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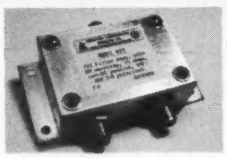

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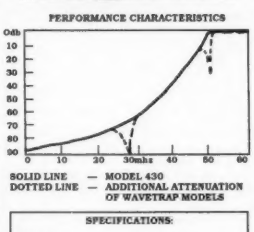

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LOOKING WEST

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Meet Peyton Montcure

In the October issue we interviewed Tom McMillan WB3HGW, the man responsible for the FCC decision to relax CW testing standards in upgrades for the handicapped. In the December issue, we interviewed April Moell, a professional occupational therapist who uses amateur radio in the rehabilitation process. Now we come to the other end of the spectrum. To a man who feels that no handicapped person should be required to pass any form of Morse code test for a ham ticket anywhere in the world. So emphatic in this quest is law student Peyton Montcure that he has taken his demand to the United Nations, and he may soon take the United States to court.

What follows is the transcript of an interview that aired during last summer's second "No-Code National Teleconference Radio Net." Montcure was interviewed by *Newsline* correspondent Steve Bauer KC0HF. Ironically, being blind, Bauer himself is a handicapped person.

From the No-Code Teleconference

Bauer: Who is Peyton Montcure and how did he become interested in amateur radio?

Montcure: I became interested in ham radio years ago when a ham radio operator came to my house when I was still a child, and gave me a little introduction. I was very interested in it—but I couldn't use a telegraph key. I found that I simply couldn't coordinate my muscles so that I could get any sort of rhythm or speed. I gave it up and forgot about it and went on with my life.

Since then, I went through college and my learning disability was diagnosed. I found out, for example, that I cannot use a manual typewriter, but I can use an electric typewriter or a word processor. Again, it was the same problem with physical coordination.

I went to law school and began to get very interested in issues related to the handicapped. One day I thought that I would write to the FCC—because I had some time and I thought it would be fun to get into ham radio. I had recently attended a talk that a ham radio group held suggesting that people might like to get involved in it. Much to my surprise, and indeed shock—because I thought that so much progress had been made regarding issues for the handicapped—I found that the FCC would not even accept my complaint!

They did not even appear to know what a civil rights complaint was. They didn't want to waive the code for me or anyone. But I managed to work my way up the chain, finally writing a letter to President Bush, and getting the FCC to accept my civil rights complaint.

They have since rejected it, which they are entitled to do, giving as a reason that the Americans With Disabilities Act of 1989 has not yet been passed by Congress. But of course it will be. As soon as it is passed, I will file another civil rights complaint. Either the FCC will change its rules so that the code will be waived for the handicapped, or I will end up filing another complaint.

After all, the object is to integrate the handicapped into American society, and one of the best ways to do this is to get them fully into transportation, and in this case, communications.

Bauer: The commission has recently announced that a handicapped applicant—after passing a 5 word per minute code test—with proper medical certification will not be required to pass additional code tests. Does this change the FCC rules enough to basically satisfy your need and make you happy?

Montcure: No, this does not satisfy me or make me happy. The FCC apparently has a battle going on internally as to whether they are going to keep the code or not. The point at issue here is this: If I am in a wheelchair outside the FCC building and want to get inside, would they tell me that I have to get up out of my wheelchair and struggle up the steps at 5 or 20 steps per minute? Why can't I use the ramp? If I am handicapped and cannot use the code at all, why should I have to learn it? It just does not make sense.

Bauer: What about the theory part of the test? Should that also be waived for anybody that claims a disability in that area?

Montcure: I can't see what sort of disability would necessitate waiving any other part of the test. A civil rights official would really need to deal with that issue. If somebody could present information proving that they could not handle some particular part of the test, maybe some modification to some other part of the test would be appropriate. I frankly cannot imagine any problem there, because we are certainly not talking about any physical handicap.

Bauer: How would you respond to a handicapped person who had passed a code test, and who challenged you on your particular views regarding the handicapped and code testing?

Montcure: I would first congratulate them on being able to pass a code test or use a manual typewriter. But handicaps do vary from individual to individual. Some can do it, and some can't!

If you can do it, fine. But the object here is to arrange for the handicapped to communicate like everyone else, and not to restrict them by some arbitrary or capricious standard, such as using a key which is irrelevant to voice communications.

Bauer: Let's assume that you have passed the state bar and you are a practicing attorney. How would you feel if the firm you were working for hired someone who used their handicap to get out of taking 50% of the courses you had to pass in order to become an attorney?

Montcure: It would depend on the particular courses. Certainly I would want them to take the courses that are necessary to practice law, but if the Board of Bar Examiners also required the individual to run a marathon, and then swim, and canoe, and do certain other physical exercises, I would not see any sense in that. In other words, each separate test must have a reason behind it that justifies it, and that justifies excluding individuals who cannot pass it. The code test simply does not meet that test.

"I can understand . . . that the FCC might like to pass a law saying that people who . . . qualify without learning the code are absolutely forbidden from using a code key, by law!!"

Bauer: But you may get on the air and never have to figure out an Ohms Law formula! I guess what I am trying to find an answer to is where do we stop cutting? Where do we stop diluting the requirements for not only amateur radio but for other things?

Montcure: In the language of the 1973 Rehabilitation Act that Congress passed, the question was whether the handicapped person is otherwise qualified. I cannot see how someone who did not know electrical theory could be qualified to operate a ham radio station. That is very important to the operation of amateur radio gear. And I can understand, for example, that the FCC might like to pass a law saying that people who cannot operate a code key, and who do qualify without learning the code, are absolutely forbidden from using a code key, by law!!

Bauer: When the FCC formalizes their new proposal concerning waiving upgrade CW tests for handicapped persons, will you try the 5 wpm test yourself?

Montcure: I expect that the Americans With Disabilities Act will be passed by Congress very shortly, and that requires accommodation in communications. As soon as that bill becomes law, I intend to file another civil rights complaint, and I imagine that the code standard will be done away with for those who cannot operate a telegraph key.

Naturally, if it were found that I or some other handicapped individual could manage the key in order to broadcast, that would be fine. But five words per minute is absurd!

Bauer: Have you done any studying for the theory part of the test?

Montcure: I certainly would not want to start studying for the thing until I know that I will be permitted some day to operate ham radio. I shall not start studying until at least the Americans in Disabilities Act passes, or until the FCC decides the complaint in my favor.

Bauer: What class of license would you go for?

Montcure: I would only be interested in a fairly basic license. I suppose in future years I might decide that I want to go for a higher class, but I am just a beginner and when you are a beginner you want to start at the beginning.

Bauer: Thank you for your time.

[An audiocassette of Steve Bauer's interview with Peyton Montcure, edited for air over repeaters and on nets, is available for $5.00 postpaid from The Amateur Radio Newsline, *Editorial Office, at my address at the top of this column. Prepaid only. No COD or credit cards.]*

Epilogue

About a month after Steve Bauer interviewed Peyton Montcure, Congress passed the Americans With Disabilities Act. A week later, in a nationally televised ceremony, the bill was signed into law by President George Bush. This has opened the way for Peyton Montcure, and possibly others, to again challenge the need for handicapped applicants for amateur licenses to pass a Morse code test at any speed.

It's not the job of "Looking West" to pass judgment on the issue. Rather, that is for each one of us to do individually. What we have tried to do these past several months is to provide a good cross-section of the views. Now it is really up to the FCC, and possibly the federal courts. Only time will tell.

Next Time Around

"Looking West" will be back in April to discuss the rights of repeater users. Just how much power should users have over the way a repeater is run? One California coordination council says that the time has come to recognize the users of repeaters as the supreme beings, and in doing so, they may have relegated repeaters to ham radio public utilities, and their owners to becoming unpaid service providers! Join my guest co-writer, Rich Yarigian N6PVP, as we explore this issue. . . . de WA6ITF 73

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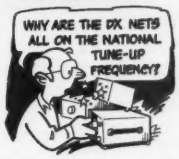

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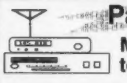

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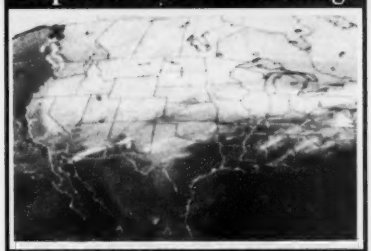

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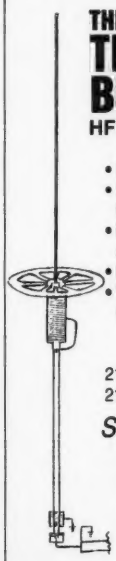

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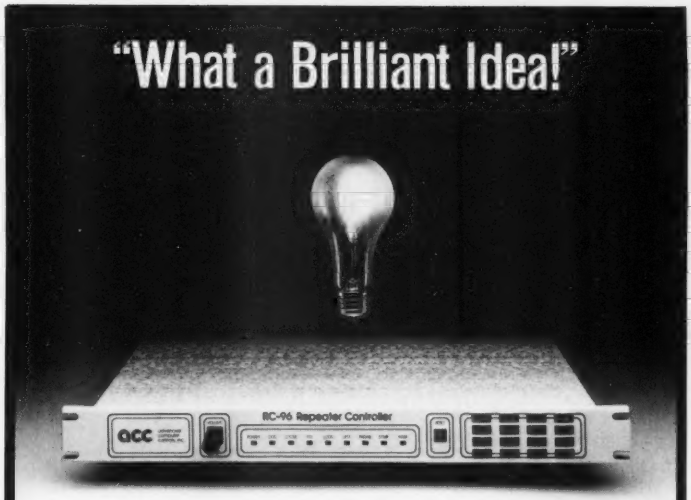

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Never Say Die

Continued from page 4

free passes for the vendor area. And then they were even angrier when some of their booth salesmen sneaked into the paid area, got caught red-handed buying equipment, and were thrown out when they still refused to buy tickets. How outrageous of Ham Com to stand up to these bullies! I don't recall that ever happening before.

Hey, That Was A Great QSO!

When's the last time someone told you that? How about it? Have you settled into a rigid, boring format with your contacts? How'd you like to have the hams you talk with disappointed when the contact is over and eager to talk with you again?

The fact is that you can become an absolute charmer over the air. It's easy. You're just going to have to break a lifelong bad habit. And the best part is that the better you are to talk with, the more fun you're going to have. It's a win-win situation.

Obviously you're going to have to make some changes. Well, you know for sure that the way you've been going about making contacts hasn't worked well. Oh, sure, you've been swapping signal reports and stuff. But how many really fascinating contacts have you had recently?

Am I about to divulge some great secret? Some key to the hidden, almost completely untapped wealth we have available to us in amateur radio? Yep! That's about the size of it.

Let's go about this logically first, then we can go into the nuts and bolts. We'll start with the most basic question: Who is the most fascinating person in the world to the ham you're contacting? Clue: It isn't you. Revelation: It's him!

Now, a note to women's libbers, who have been working industriously to louse up the language: What few women hams we have do not need any help with spiffing up their contacts. Merely being women will make them interesting to men. My comments here are meant for men, who are the ones with the problem. You know, I haven't heard a YL on the air in months! Where are they? (I'll tell you later.)

Sorry for the diversion, but I knew that as soon as I mentioned "he" for a ham, I'd have a flurry of furious letters from militant YLs. I wish they'd spend more time on the air and less angrily fighting for their "rights." If we had more YLs on our bands I wouldn't need to write about how to have more interesting contacts.

Okay, I've established the obvious: The most interesting person in the entire world to the chap you've contacted is him. Thus it follows that the more you can get him to talk about himself, the more he's going to enjoy the contact.

In case you're not following my message, your usual recitation doesn't cut the mustard. He really doesn't give a damn what rig you're using. He won't be amused by your weather, town, antenna and so on. Whoo, that sure cuts down on your transmissions, doesn't it?

If you aren't going to babble the usual dreadfully boring drivel, what **can** you talk about? How about mentioning what kind of work you do and then ask him what he does . . . or perhaps what he did before he retired? There are many questions you can ask that will open the floodgates.

How did he get involved in amateur radio? Are his kids hams? Why not? Has he ever gone to the Dayton Hamvention? What other aspects of the hobby has he tried? Start making a list of questions which you've found to get the conversation going and keep it by your log.

Step two is to keep your log in much more detail. Make notes on what your contact is telling you so the next time you contact him you'll be able to recall the conversation and carry it on from where you left off. Your best bet here is to use a computer. Second best is to use paper, with a dedicated separate sheet for every contact. Don't try to cram it on a 3" x 5" card. Not even a 4" x 6" card. Go wild and use a whole sheet. Put the call in the upper left hand corner and keep your contacts by call in a file folder close at hand.

You'll get me talking if you ask about some of the countries I've operated from. Or about some of the exciting times I've had on the air. Or the interesting hams I've known. Or my first hamfest (1938). I've had some great adventures in my hamming . . . even some close calls with death. How about you?

Men Don't Talk Much

There is a basic difference between how men and women communicate. It starts when they first learn to talk. Boys play with each other. Girls ditto. The differences in their communications are basic and biologic. Boys are basically adversarial and girls aren't. Alas, most men never learn to actually talk with their wives . . . and vice versa.

With men it's our egos on the line with every contact. With women it's their hearts on the line. We want to see who's best and they want to be loved, putting it bluntly. Having been brought up from year one like this, it takes some serious habit breaking to change. Is it any wonder we have so few YLs on our bands?

Maybe you've noticed that men tend to make a contest out of anything and everything. How many countries we've worked is a measure of our masculinity. How many counties, certificates, how we do in operating contests, how big our rig, our antenna, how elaborate our mobile rig, etc.

They don't call the Cadillac the answer to America's inferiority complex by accident. We're trying to cope with feelings of inferiority with bravado and big signals.

DXers are well aware that DXCC is a serious threat to our hobby and could wipe it out at WARC. But egos are on line here, backed by millions of dollars in monster antennas and multi-kilowatt amplifiers. These DXers have no interest whatever in talking with anyone. They want a card. They need a card as badly as a crack addict needs a fix. And they'll spend whatever it takes to get the card.

There are a few ops in rare countries who have been making a happy living off these egos. They sort out the "green stamps" in their daily mail. I am old enough so I can remember when hams used to send a dollar to assure a QSL. Now anyone really wanting a DX QSL wouldn't consider less than a $20 bill. Some tell me they send $100, "just to be sure."

I've told you about the DXpeditioner who bragged about clearing over $50,000 a year tax-free in such "donations." And that was 30 years ago, so that's more like $500,000 in today's dollarettes. It's almost enough to get me to retire and do some traveling.

I'm Listening

Yep, I'm going to be listening to see if you are able to change your ways. Will you start asking questions and listening, or are you going to keep right on just "broadcasting" the same old tripe? Unless you can get started actually communicating instead of egoing yourself all over the world, the bands are going to keep right on being a dreadful bore.

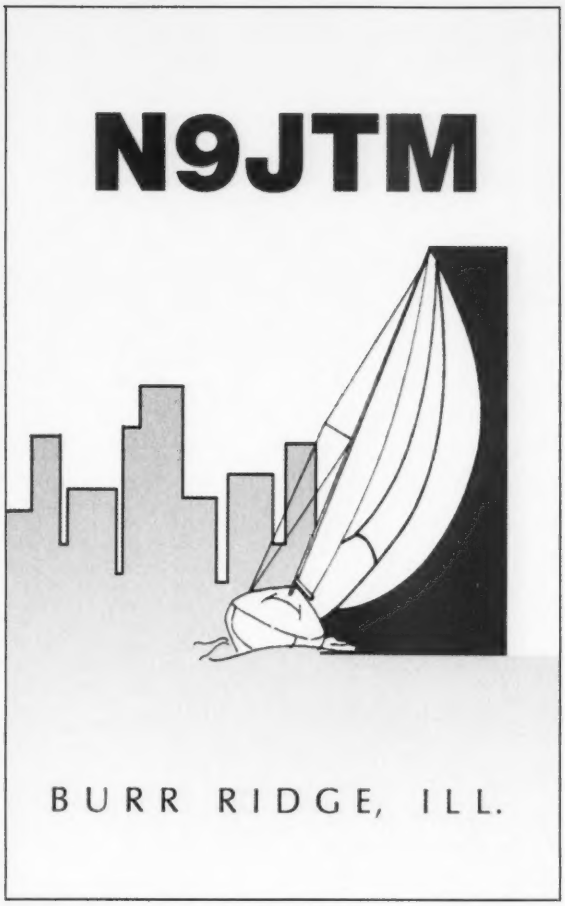
Now I'll see how many readers write that they don't always agree with me. If you disagree, let me know why. And I want a well considered response, not an angry, ego-driven one. Who knows, we might eventually even be able to talk with YLs over the air!

Did you see *When Harry Met Sally*? Well, rent it. Billy Crystal explains why men and women can never be friends. It's humorous, but it's true, too. Can we men, after being trained from birth to be the way we are, ever change?

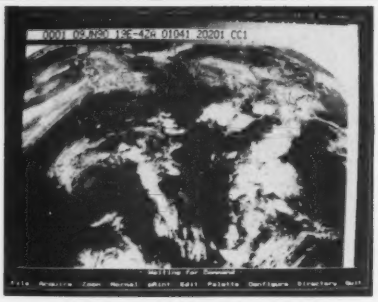
No Code—At Last!

Okay, it's here . . . finally! The FCC took the easy (and clever) way out. They merely eliminated the code requirement for the Tech license. If 2m doesn't turn into a CB-type mess in days, thousands of old-timers are going to be terribly red-faced, since that's what they've been saying would inevitably happen.

What change will this make? Firstly, it will remove the last feeble excuse kids have for not getting a ham ticket. And I'm talking major feeble here, considering that people who use the *73*



QSL of the Month To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year Subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.



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CIRCLE 24 ON READER SERVICE CARD

code system can usually master 5 wpm in a couple hours.

Is this marvelous rule change going to bring us the 50,000 new hams a year the ARRL promised they'd provide? I laugh. My view: If we stood on a corner in New York and tried to give away ham tickets we couldn't do it. The general public no longer has the vaguest recollection of what amateur radio is. We've so totally avoided promoting our hobby for the last 25 years we're now almost invisible.

With no 5 wpm code test for Techs I believe we'll find that those we are able to interest in going on to General will be able to learn 13 per much easier. Those few hams who have started right out at 13 wpm and avoided slower speeds have been able to master the code in a few hours instead of living through months of grinding frustration.

A number of readers have suggested that I start a new national organization and do the amateur radio promotion which needs to be done. No, I don't need the aggravation that fighting the League would bring. No, you're going to have to either clean up the ARRL or else take up a new hobby when we lose this one through neglect.

We need to do something to revive an interest in CW. Our bands are split into CW and voice subbands, but it doesn't take much listening before you discover that the voice bands are busy and the CW bands oddly vacant. I've gotten several letters recently from hams who've taken the time to count signals on a regular basis. This might be a good club activity. Assign different bands to your members and get them to make an hourly activity count of CW, RTTY, Packet, SSB, SSTV and AM signals on each HF band.

If you'll run the counts and send 'em in, I'll get 'em correlated so we'll have something approaching a scientific study. We need to know how much activity we have on what bands . . . when. In counting, never mind how many stations are in nets. We just want to know how many frequencies are being used for contacts . . . so a net or even a DX pile-up would count as one contact.

In sending in reports, please mention if you're part of a club activity (and the club). I'd like to publish a list of the clubs which have shown enough interest in the hobby to help with projects like this.

As far as I know nothing like this has been done by amateurs before. Some commercial studies of amateur band use have been done in preparation for pressuring the FCC to give them parts of our bands. They used wideband spectrum analyzers and video tape . . . which not many of us have access to.

The Pudding

Will this new no-code Tech license open the floodgates and get us into a growth mode again? I hate to be Ol' Doc Gloom, but I'll be surprised if this alone makes much difference. We'll know more a year from now when we can compare the change in new licenses being issued. 73

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NEW ADDED FEATURES

CIRCLE 160 ON READER SERVICE CARD

Arnie Johnson N1BAC
103 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

Several weeks ago after parking my car at work, I was pleasantly surprised when a car stopped, and a young man stepped out and asked me if I was a ham. He had seen my callsign on my license plates and wondered if I knew of any local clubs offering ham classes. I had to admit that I didn't, but that I'd check, and that he should call me at my office.

I haven't found a club yet with classes going on, but I've been thinking about trying to do something myself. In the non-ham world, I teach at a small liberal arts college in New Hampshire. What about a one-semester ham course, meeting about one evening a week? That'd be at least 14 meetings. My understanding from other faculty is that there used to be a ham station on campus for faculty and students. It appears that the ham shack and equipment have passed into oblivion. But ham radio has not! Anybody in the Rindge, New Hampshire, area want to help me?

This brings up a subject I discussed with David N1GPH, my fearless leader (after Wayne, of course). Wouldn't it make sense for 73 Amateur Radio Today *to sponsor ham classes at the elementary and high schools in the New Hampshire area? David said that it would, but only if people wouldn't think that* 73 *was doing it just to sell subscriptions and Wayne's code tapes and study material.*

I had to admit that I hadn't thought of it that way, but he was probably right. Then I asked my favorite question, WHY? WHY can't ham radio magazines and their employees sponsor ham classes? WHY can't we use some of the magazine's resources to increase the numbers in our wonderful hobby? Don't many of our clubs strongly suggest to our struggling Novices-to-be that they purchase one set of code tapes or the other, and one particular study guide or the other? WHY is that any different from 73 *or* QST *or* CQ *suggesting that the student use certain study materials?*

Since this column is supposed to zero in on international happenings, I will pose the same question to ALL hams. WHY can't ham magazines use their integral talents and resources to increase the ham population of the world? You tell us whether ham magazines should or shouldn't be able to sponsor ham classes.—Arnie N1BAC.

USSR

Early in 1989 a new radio club, "Advanced Communications DX Association (ACDXA)," was formed in the USSR to promote the usual good things that radio clubs try to do, such as foster international friendship and good will, and sponsor contests and expeditions. The founders are Valery RA9YD and Yuri UA9YE. Both are officers of the association.

ACDXA Awards Program. The ACDXA awards will be issued to any licensed amateur or listener over the world.

Each contact must be confirmed in the form of a QSL card received by the applicant.

Each application must be accompanied by a list showing the dates of the contacts, and include a statement by two licensed amateurs that the necessary cards have been checked.

Contacts must all be made from the same country, on any band or mode, beginning January 1, 1985, if a specified requirement is not indicated in the rules.

After receiving the basic award, only the necessary additional confirmations are required for a higher class or endorsement.

The certificates are available for a fee of 7 IRCs or 3 IRCs per endorsement.

The cost of a plaque or trophy is 50 IRCs. In all cases the fee includes surface mail return postage. SCA and ACDXA Supertrophies are free.

Applications must be sent to the awards manager, ACDXA, PO Box 1, Barnaul 656057, USSR.

ACDXA. The applicant has to prove QSOs with 5 ACDXA members.

The ACDXA plaque is available for any applicants who have [been able] to prove contacts with each current ACDXA member.

Only contacts made on or after January 1, 1990 are acceptable.

All Soviet Nationalities Award (ASNA). In the spirit of developing friendly relations among nations and nationalities, the award will be issued to encourage communications with different national areas within the Union of Soviet Socialist Republics.

See the table for the basic award and trophy rules.

Territories for ASNA: Soviet Socialist Republics: UA, UB, UC, UD, UF, UG, UH, UI, UJ, UL, UM, UO, UP, UQ, UR.

Autonomous SSRs: UA1N, UA4P, UA4S, UA4U, UA4W, UA4Y, UA6I, UA6J, UA6P, UA6W, UA6X, UA9W, UA9X, UA0O, UA0Q, UA0Y, UD..N, UF..Q, UF..V, UI..Z.

National districts: UA1P, UA8T, UA8V, UA9G, UA9J, UA9K, UA0B, UA0H, UA0K, UA0X.

Autonomous oblasts: ..UA6E, UA6Y, UA6Z, UA0D, UA0W, UD..K, UF..O, UJ..R.

Soviet Cities Award (SCA). The applicant has to prove contacts with 100 cities of the Soviet Union.

Special endorsements are available for each additional 100 cities.

SCA-trophy is available for the achievement of 500 cities.

SCA-Supertrophy is available for achievement of all cities worked on the date of the application signed. All QSLs and appropriate return postage are to be sent to the awards manager.

The list of the Soviet Union's cities is available from the awards manager. Please SASE or SAE and 5 IRCs.

Good Neighbor Award (GONA). The applicant has to prove contacts with all countries which border the USSR.

Special endorsements for any band or mode are available.

The GONA-plaque will be issued to an applicant who has [been able] to prove contacts with all countries as those for GONA-certificate on each of five HF bands.

One necessary contact on each band may be substituted for a contact with another country adjacent to the necessary country, if the contact has been made on RTTY, AMTOR, or packet.

The list of countries: AP, BY, EP, HA, JA, JT, LA, OH, OK, PS, SP, TA, VU2, W, YA, YO.

"Ninety-Degree Line." The applicant has to prove contacts with those foreign countries and Soviet oblasts which lie on the 90 degree meridian. A5, BY, HC8, JT, S2, TG, UA0A, UA0B, UA0H, UA0W, UA0Y, VE, VU, W, XE, YS.

U-RTTY-Award. In an effort to encourage digital communications on radio amateur bands, the U-RTTY-Award will be issued to any amateur or listener who can prove contacts with all ITU-zones within USSR (19–26, 29–35).

ACDXA-Supertrophy. The ACDXA-Supertrophy may be claimed by any holder of the following: ACDXA-plaque, SCA-trophy, GONA-plaque, ASNA-trophy, and U-RTTY-Award.

	USSR	DX
Basic award	51 QSOs*	25 QSOs**
Trophy	51 QSOs – 5 Bands***	51 QSOs – 3 Bands****

* – 15 Soviet Socialist Republics
20 autonomous SSRs
10 national districts
8 autonomous oblasts
any band, any mode

** – 10 Soviet Socialist Republics
15 autonomous SSRs
any band, any mode

*** – 51 QSOs on each of 5 HF bands, any mode
**** – 51 QSOs on each of either three HF bands, any mode

[In the following, please note 9M6HF's comments on pile-ups and the purpose of amateur radio. You can enjoy contesting and still be considerate—and maybe even take a few moments to talk about your interests and activities!]

MALAYSIA

Harris Abdullah 9M6HF
P.O. Box 13329
88837 Kota Kinabalu
Sabah Malaysia

Local activities. MARTS has, for the third year running, provided communication facilities during the Rally of Malaysia from September 1–4. This event, organized by the Malaysian Motor Sports Club (MMSC), gives MARTS members the opportunity to improve their traffic handling abilities. MMSC also organizes the World Superbike Championship on November 1–4 in Shah Alam, with MARTS participating.

The SEANET Convention was a success, attracting amateurs from 18 countries. As I was not able to attend the convention, I am not able to write a detailed report. This event, sponsored by the state government, was very well-organized, thanks to Festus Havelock 9M8FH. Due to his effort, interest in amateur radio in Sarawak has been revived. More stations with the 9M8 prefix should be on the air soon.

In 9M6, licensed amateurs and SWLs did their part in community service by providing the total communication facilities for the Climbathon, an annual mountain race up and down Mount Kinabalu (4,100 meters), organized by the Sabah Tourism Promotion Corporation. Held September 1–2, this is the second year in which the Sabah Amateur Radio Society has provided the service. Control stations were set up at intervals along the route to the peak. The guys who had volunteered to be stationed at the peak had to trek up the mountain from the base. As the event was held over two days, these poor guys had to do that twice, except that the second day's trek was from the resthouse located at the 3,000-meter level.

DX Activities. In 9M2, a number of amateurs are active on the air. Among them are: 9M2ZA, Zainal; 9M2AX, Ross; 9M2DX, Faizal; 9M2DW, Tan; 9M2GW, George; and 9M2KN, Ken. These are the stations I know of who are on the air frequently, and who can be heard mostly in the evenings (0700 UTC onwards). Other stations are also active on the HF bands at other times.

From 9M8, regulars on the air are: 9M8GH, Festus and 9M8PV, Andy. 9M8FH sometimes checks in with the W7PHO Net on 14.226.5 MHz. 9M8ZR (WA2HZR, Dave) was active in November, operating the last week of that month from Western Malaysia with the call 9M8ZR/2.

Active stations from 9M6-land are 9M6MO, Mohammad; 9M6JR, Janin; 9M6ET, Steve; 9M6IQ, Senny (YL); 9M6HS, Hussein; 9M6MA, Hassan; 9M6MU, Alfons; and myself. All these stations are active on most weekends. 9M6MO has regular weekend skeds on 21.160 at 0800 UTC with his QSL manager. 9M6ET meets his QSL manager on 21.220 at 2300 UTC, and 9M6HF has a regular sked on 21.350 at the same time during the weekends. Of course, contact depends on the propagation conditions.

Stations soon to be on the air are 9M6MX, Mann and 9M6AF, Ken.

I am able to work all modes and bands except satellites and 160m. The only satellite station belonged to 9M6KT, Mike, who went QRT when he returned to the states last November. Most of the stations mentioned above have modest setups and only dipoles. 9M6MO, 9M6MA, 9M6MU, and 9M6HF are the only stations with tribander yagis.

9M6NA, Sate (JE1JKL) and 9M6OO, Bob (N2OO) were active from the middle to the end of November 1990. 9M6QQ, Hans, was also on the air during the same period, operating from two islands, Labuan and Banggi, for the IOTA award.

Local Growth. The amateur radio community is growing, albeit at a very slow pace. MARTS reported recently that there are 309 licensed amateurs in Malaysia, which includes Sabah and Sarawak. SWLs, of course, outnumber these by a factor of at least 2 to 1. It's quite amazing at how easily a 9M prefix attracts a pile-up, especially when the bands are open. Working through a pile-up is a tiring job, and most of us here prefer a nice chat and getting to know the operator at the other end, instead of trying to break their QSO record. Isn't the main aim of amateur radio to strengthen international goodwill and friendship? So, how do you achieve this by exchanging callsigns and signal reports? If you have an answer, I would be glad to hear it. 73

ATV

Number 27 on your Feedback card

Ham Television

Bill Brown WB8ELK
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The "Lookie-Talkie"

With the current trend towards miniature video components, it was inevitable that someone would come up with the video equivalent of an HT. Earl Campbell KS8J of Glendale, Arizona, has put together what he calls the "Lookie-Talkie." (See Photo A.) Take a small pocket portable TV set, a 1 watt ATV transmitter, a miniature B/W TV camera, preamp, gel cell and a 440 MHz rubber duck antenna, then mount it all in a plastic project box and you have an extremely portable ATV station. Now when Earl wants to go portable or mobile ATV he just grabs the "Lookie-Talkie" and heads for the door . . . no messy cables and adaptors to worry about!

Photo A. The "Lookie-Talkie."

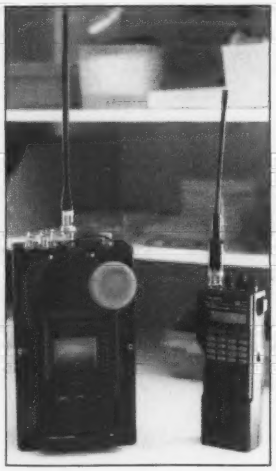


Photo B. The "Lookie" compared with a Yaesu 2 meter HT.

Build your own "Lookie"

Use a Radio Shack Pocketvision 22 (the 23 and 24 models will work as well, but are somewhat larger) for the ATV receiver. This series of pocket LCD TVs tune directly through the 70cm ATV band and even tune below 421.25 MHz. With the addition of a Hamtronics preamp kit (LNW-400), you will have a very sensitive receive station.

Remove the back of the TV set to conserve room and mount it through a hole in the lid of a plastic project box

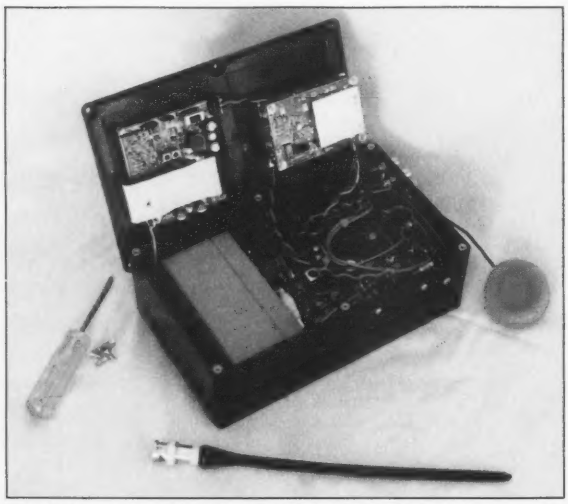
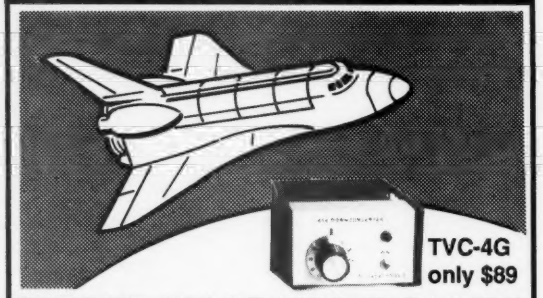


Photo C. Internal view of the "Lookie". Note that the TV camera and the back of TV receiver have their cases removed. Main part of the case contains the Kreepie-Peepie transmitter and the battery.

Photo D. KS8J ATV repeater site on top of Shaw Butte overlooking greater Phoenix. Roger KD7HH and Wayne N7MAO can be seen installing the new antennas.

Continued on page 78

AMATEUR TELEVISION



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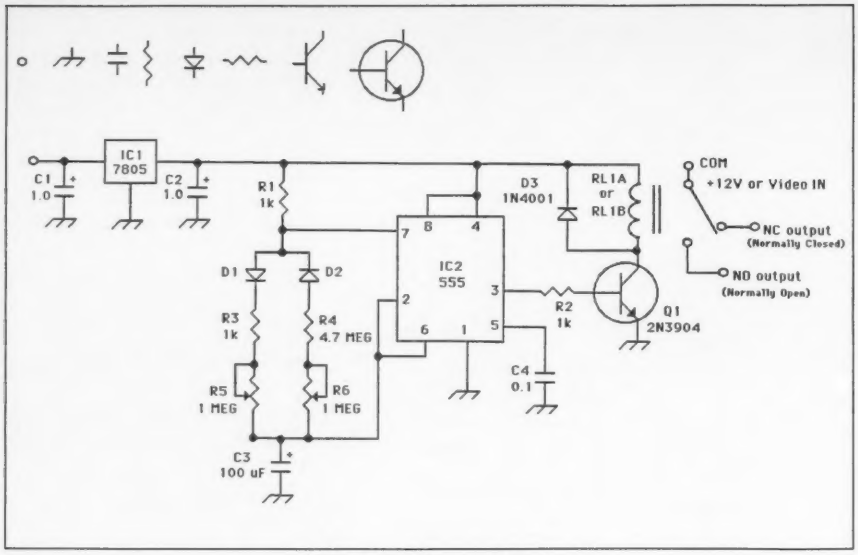

Figure 1. Ten minute timer schematic.

(RS# 270-224 or 270-232). (See Photo C.) Connect a Hamtronics preamp between the TV set's antenna jack and the DPDT antenna switch on the top of the box next to the BNC antenna jack. Just above the TV receiver, mount the small B/W TV camera with its case removed. This particular model was the Mitchell Industries Micro-Video camera. (The GBC CCD-100 is a similar sized camera and could be used as well.) Mount a P.C. Electronics KPA-5 transmitter to the back of the project box just above the 1.2 Ah gel cell battery.

The DPDT switch on the top of the box is used to switch the antenna jack from transmit to receive, as well as to supply power to turn the ATV transmitter on and off. Optional switches can be mounted for external audio or video inputs as well. Button it up and you should be ready for some real portable ATV action.

Walking around Phoenix with the "Lookie," Earl can watch the local ATV repeater with a P3 or better picture from over 20 miles away. He has taken it up on several flights on board a research jet for some really wild DX. His most recent flight took him from Arizona to Italy on a Cessna Citation jet at 42,000 feet. During this flight he used the "Lookie Talkie" to make aeronautical ATV contacts in Arizona, Minnesota and Great Britain!

Now that the video HT is a reality, who'll be the first with a Dick Tracy style ATV wristwatch?

Phoenix ATV

The AAA5 of Phoenix (Arizona Amateurs on A5) have quite an active group. Their local ATV repeater (KS8J/r) is about 2100 feet above the city on top of Shaw Butte. (See Photo D.) Shaw Butte is centrally located and provides coverage over a wide area of greater Phoenix. P5 quality reception has been consistently seen over 40 miles away. The repeater is vertically polarized with an input on 434 MHz (923.25 MHz alternate receive). Output is on 421.25 MHz. Most stations in the area need only 1 watt to access the repeater, so amplifiers are used only for distant simplex contacts or for mobile use. If you are in the Phoenix area, look for their weekly ATV net every Wednesday night at 7:30 p.m. The 2 meter talk frequency is via the 145.17 repeater (−600) or 145.17 MHz simplex. They can also be found on the 147.28 (+600) repeater during net nights as well. No need to wait for the net, however, since there is tons of activity most any night!

Ten Minute ID Timer

This little circuit (Figure 1) solves the problem of identifying your ATV system every 10 minutes. You can use it to automatically switch in another source of video via the onboard relay (computer or identifier), or use it to switch 12 volt power to another relay or device. There are spaces for two different kinds of relays on the board (only one relay is necessary). I prefer the Aromat relay since it draws less current. This circuit will drive both relays, however, if you'd like to control more than one device (see Figures 2 & 3). The 555 (use the standard 555, not the CMOS version) timer charge and discharge paths are independently controllable via the 1 MEG control pots. I usually set it up to ID for 5 seconds every 10 minutes. I've used this same circuit in my live camera balloon flights to kick in the video ID board for 30 seconds every two or three minutes (using a 22 or 33 µF capacitor for C3). It's been a reliable performer and fits in a small space. You should use a high quality tantalum or low leakage electrolytic for the timing capacitor. To set up the on/off ratio initially, use a capacitor that is 10 times less than your final value. That way you can make your adjustments without having to wait a full 10 minutes! Then just replace the small capacitor with the final value. If you can't achieve the desired delay interval with the adjustment pot R6, try varying the values of C3 and R4. 73

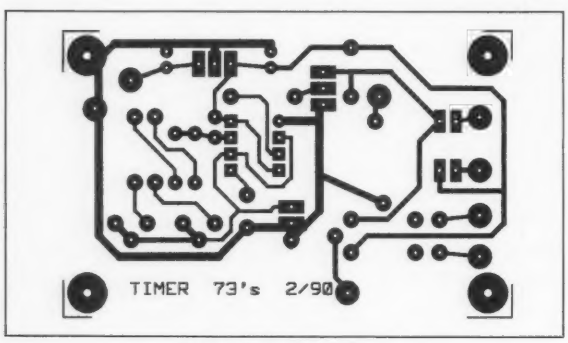

Figure 2. Timer PC foil pattern.

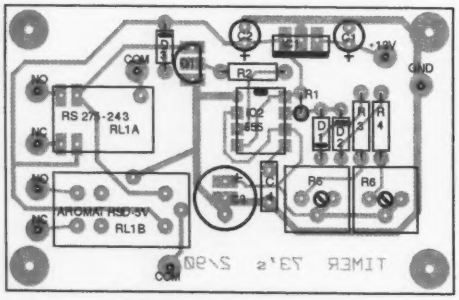

Figure 3. Timer parts placement.

Parts List (Ten Minute Timer)

R1,R2,R4	1k ohm ¼ watt resistor
R3	4.7 MEG ¼ watt resistor
R5,R6	1 MEG potentiometer
C1,C2	1.0 µF/35V tantalum capacitor
C3	100 microF/16V tantalum or electroytic capacitor
C4	0.1 microF disc ceramic capacitor
IC1	7805 5V regulator
IC2	555 timer IC
Q1	2N3904 NPN transistor
D1,D2	1N914 diode
D3	1N4001 diode
RL-1A	5 volt relay, RS#275-243
RL-2A	5 volt relay, Aromat RSD-5V (note 2)
Misc	8-pin IC socket, PC board (note 1)

Note 1: A blank PC board is available from FAR Circuits, 18N640 Field Court, Dundee IL 60118 for $4 + $1.50 shipping/handling per order.
Note 2: The Aromat RSD-5V relay is available for $2 + $1.50 shipping from ARE Surplus, 15272 S.R. 12 East, Findlay OH 45840. Phone: (419) 422-1558.

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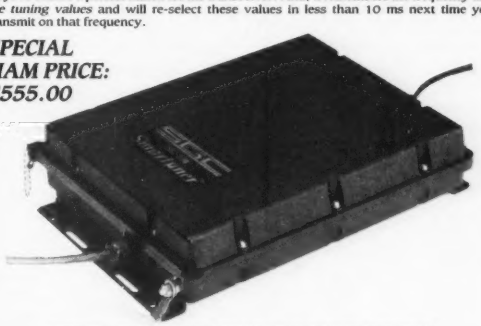

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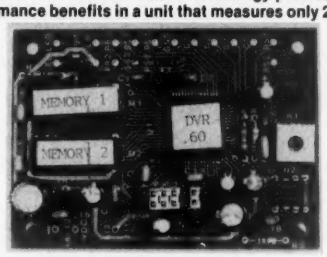

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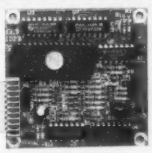

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The Satellite Programs

Most universities do not build their own spacecraft. Until 1979 the University of Surrey in England was no exception. British university involvement prior to 1979 concentrated on the development of sensor systems, instrumentation, and detectors for experiments on board satellites built by industry.

Dr. Martin Sweeting G3YJO recognized an opportunity to expand the involvement of the University of Surrey to build small, low-cost spacecraft. Offered a launch opportunity by the United States, he and a small group of researchers in Surrey built not only satellite subsystems, but a whole satellite with its own power systems, experiments, control circuits and transmitters.

The goal was to create a satellite that could be monitored using simple systems on ham radio frequencies. The experiments were to be complex enough to stretch the abilities of university students, but still keep the emphasis on making the system output useful for educators at all grade levels, as well as for amateur radio operators. Experiments included a magnetometer, radiation counters, a charge-coupled device (CCD) camera, and an array of shortwave propagation beacons.

As Martin pointed out, today's school children are tomorrow's university students, and eventually our future spacecraft engineers.

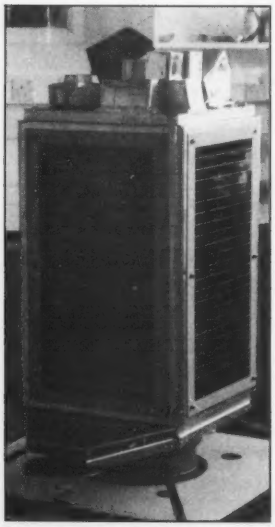

Photo A. This "fit-check" model of U-O-11 (launched 7 years ago) sits quietly in a lab at Surrey. (N5FVM photo)

UoSAT-1

UoSAT-1, also known as UoSAT-OSCAR-9, was launched by NASA on October 4, 1981, from the Vandenberg Air Force Base in California with the Solar Mesopheric Explorer. The launch vehicle was a Delta rocket. For the first days of its life, U-O-9 sent only an unmodulated carrier. Finally on October 9, 1981, the staff at Surrey managed to command U-O-9 to the 300 baud ASCII downlink mode. Until its fiery end in the atmosphere on October 13, 1989, U-O-9 sent telemetry either digitally via RTTY, CW or ASCII, or through the digital speech synthesizer system detailing the status of onboard sensors and experiments. The mission proved the viability of a university-inspired satellite program and generated interest from academic, technological, industrial and commercial sectors.

The success of the UoSAT-1 program encouraged G3YJO and others to continue with small satellites and to develop UoSAT-B, which would become UoSAT-2 or UoSAT-OSCAR-11 after launch. The U-O-11 mission was to fly a proof-of-concept digital store-and-forward communications experiment prior to a dedicated packet satellite spacecraft, and to use a launch opportunity made available by NASA.

The LANDSAT-4 Earth resources satellite needed to be replaced. The University of Surrey was officially informed of an opportunity in September 1983 for a ride to space in March 1984.

UoSAT-2

With only six months available, the team in England designed, fabricated, assembled, integrated and tested UoSAT-2, and were ready for another California launch from Vandenberg Air Force Base on March 1, 1984. Harold Price NK6K spent much of that time in Surrey living in Spartan conditions working with the Surrey team. The ride to orbit with LANDSAT-5 was uneventful, but only a day later the satellite would not respond to commands sent from the control station. After 10 weeks of intensive effort in England and at the Stanford Research Institute in California, U-O-11 was once again responding to commands and transmitting telemetry on 2 meters.

A logic gate had failed only hours after deployment, but the problem was not easily diagnosed from the ground.

Photo B. Mark Allery G7DSY at the UoSAT control station at the University of Surrey. (N5FVM photo)

U-O-11 is still in orbit and functioning. It is usually configured for 1200 baud telemetry on 145.825 MHz FM. The 350 mW 2 meter beacon can be heard successfully on most portable and mobile rigs. An old Bell 202-type modem with a simple modification to invert bit sense ("1" to "0" and "0" to "1") can provide the listener with plenty of telemetry to decode. Like U O-9, U-O-11 has a speech synthesizer, a CCD camera, and several modes for the telemetry downlink. U-O-11 also has a particle-wave experiment, a space-dust detector, and the Digital Communications Experiment (DCE).

UoSAT-3 and -4

On January 22, 1990, the University of Surrey added two more satellites to its continuing list of accomplishments.

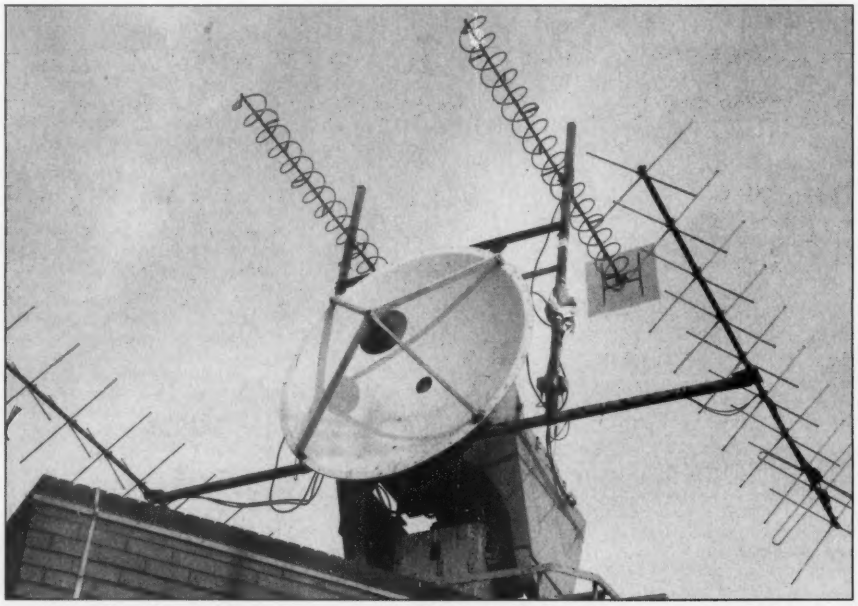

Photo C. Main University of Surrey satellite tracking antennas on a modified antiaircraft gun mount. (N5FVM photo)

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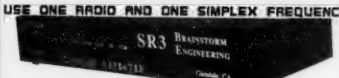

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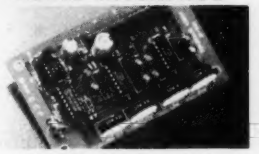

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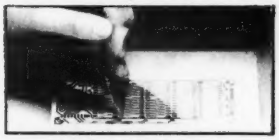

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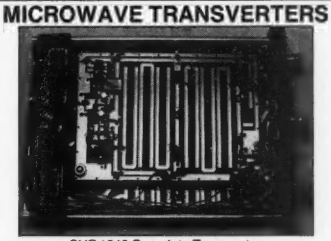

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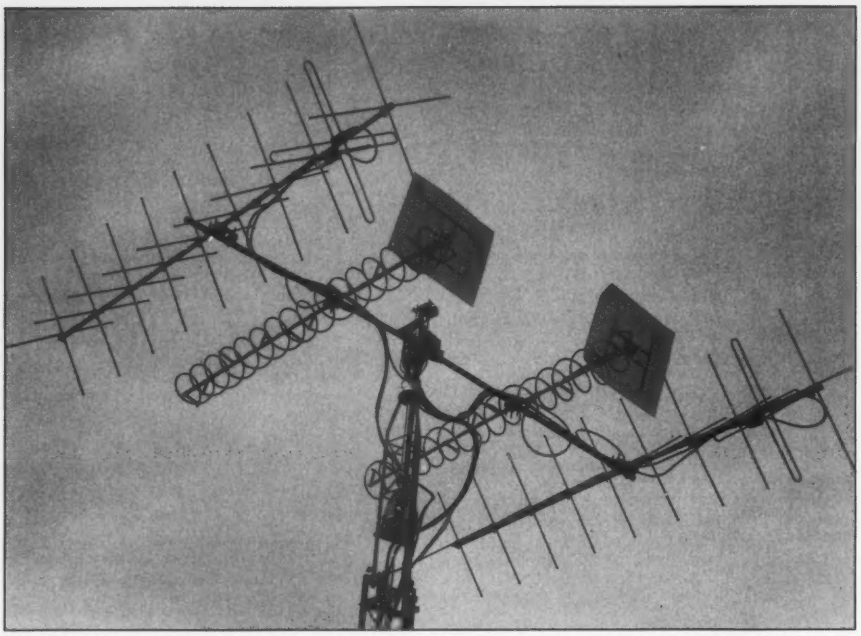

Photo D. Additional UoSAT antennas with crossed yagis on 2 meters and opposing helix antennas for 70cm. (N5FVM photo)

UoSAT-3, also known as UoSAT-OSCAR-14, and UoSAT-4 (UoSAT-OSCAR-15) were launched with the microsats by an Ariane-4 launcher as secondary payloads with the French SPOT-2 imaging satellite. UoSAT-OSCAR-14 is performing well with 9600 baud Mode "J" (2 meters up and 70cm down). The satellite also has cosmic particle and total radiation dose detection devices along with the packet radio communications experiment. Signals are loud and have been copied on incredibly simple systems. On several occasions, Jeff Ward G0/K8KA has successfully connected to the satellite BBS and transferred several large files using portable radios and small antennas. For the 2 meter uplink he used a turnstile, while a small helix provided the downlink on 70cm.

Unfortunately, little has been heard from UoSAT-OSCAR-15 since the day after launch. Experiments on U-O-15 include a camera imaging device, transputer data processing units, and advanced European-made solar cells. Efforts continue to determine why it has not been transmitting, but the chances of recovery are dwindling.

UoSAT-F

Undaunted by the probable loss of U-O-15, the Surrey team is working on its replacement. After launch the new satellite will get an "OSCAR" number, but for now it is simply UoSAT-F. Many of the experiments of U-O-15 are being built again in the labs in England in preparation for launch this April on an Ariane rocket. Research Fellow Mark Allery G7DSY and others have been putting in long hours to finish the project. As if there weren't enough to do, the group must maintain operations on the current UoSATs.

The ground station at the University of Surrey was installed in 1975 to support control activities with AMSAT-OSCAR-6. It had only a few radios in a very small area so it did the job, but little else. By 1978 the system was expanded and was known as a "telecommand center" with several radios and an impressive automated antenna system using a modified Bofors antiaircraft gun mount. The antennas are still in use today, but other systems have been added. The custom tracking gear and connections to the university's mainframe computer have given way to 386 computers and arrays of displays for telemetry and tracking. Experimenters at Surrey continue to play a pioneering role in space education both in England and abroad, and at all education levels.

The ARSENE Satellite

Another satellite program developed for primarily educational purposes is the ARSENE satellite project from France (Ariane Radio amateur Satellite pour l'ENseignement de l'Espace). Many people have forgotten about this effort because of the delays and lack of information, but the project is still alive and may be launched in 1992 with the TELECOM-2B satellite as the main payload.

ARSENE was begun in the early 1980s and includes the Radio Amateur Club de l'Espace, Centre National d'Etudes Spatiales (CNES), 27 engineering schools, universities and colleges, and support from more than 40 companies. Student contributors number in the hundreds and the program has provided 87 engineering projects and one doctoral thesis.

The satellite is to be incorporated into the launch ring adapter between the main payload and the Ariane rocket. ARSENE is to act as a demonstration of how to accommodate secondary payloads with a minimum of mass increase and interface effort. It carries two transponders, one mode "B" (70cm up and 2 meters down) digital system, and an analog (voice, etc.) unit for mode "S" (70cm up and 13cm down).

The digital "B" system includes three distinct uplink frequencies and a single downlink using standard FSK modulation at 1200 baud. This configuration was chosen to allow standard packet-ready Earth stations access to ARSENE. The downlink transmitter runs 20 watts, so it should be easy to copy from modestly equipped stations.

The linear transponder with the 13cm downlink can be used with SSB, RTTY, CW or any other analog mode. Mode "S" on AMSAT OSCAR-13 transmits on 2401 MHz. ARSENE will come down around 2445 MHz. Current Mode "S" users will need to make appropriate modifications to make the 44 MHz move. Only one mode ("S" or "B") will be active at any given time. A schedule of operating times and modes will be determined by the STELA (Station de TELecommande Arsene) ground station. An onboard radiation dosimeter experiment is also included.

Physically, the satellite is nearly a cubic yard in volume, with a launch mass of 310 pounds. The orbit is to be elliptical with a perigee, or low point, of 12,430 miles; and an apogee, or high point, of 22,400 miles. This type of orbit yields a period of about 17.5 hours for one revolution around the Earth. The apogee boost rocket weighs 163 pounds and is made of carbon fiber materials. Spin stabilization will be around the "north/south" axis, and active attitude control (alignment relative to the Earth and sun) will be controlled by nitrogen gas jets. The power budget runs about 50 watts and the thermal control will be passive. Expected life is five years.

The ARSENE program has already contributed to the teaching of space technology. After launch it will continue that mission but will also provide the amateur community with a new space resource for communications experiments. 73

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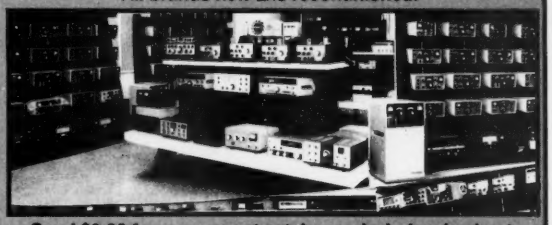

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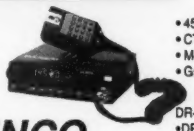

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FEB

COATESVILLE, PA Reservation deadline for the Dayton Hamvention Bus Tour is 2/28/91. $143 cost includes motel for 3 nights, and bus fare. The bus will leave for Dayton Apr. 25th at about 7 AM and return Apr. 28th. Contact *TRIAC ARC, PO Box 304, Coatesville PA 19320. (215) 269–4844.*

FEB 2–3

MIAMI, FL The 31st Tropical Hamboree Amateur Radio/Computer Show and ARRL Southeastern Division Convention will be held at the Dade County Youth Fair & Exposition Fairgrounds. Admission $5 advance, $6 at the door. Swap tables: $20 each plus registration. Power, $10 per user. 3 day campsites $40 (Fri., Sat., Sun.). 4 day campsites $55 (Thurs., Fri., Sat., Sun.). Headquarters Hotel: Miami Airport Marriott—$65 single, double. Call *(305) 649–5000.* Speak only to Reservation Dept. and mention "Tropical Hamboree" to get special rate. For brochure and reservation forms: *Chairman, Evelyn Gauzens W4WYR, 2780 N.W. 3rd St., Miami FL 33125. (305) 642–4139. FAX: (305) 642–1648.*

FEB 10

MANSFIELD, OH The Mansfield Mid-Winter Hamfest/Computer Show will be held at the Richland County Fairgrounds, beginning at 7 AM. Advance tickets $4, $5 at the door. Tables $9 in advance, $12 at the door, if available. Reservations must be received and paid by Feb. 1st. Talk-in: Call W8WE on 146.34/.94. For reservations send SASE to *Dean Wrasse KB8MG, 1094 Beal Rd., Mansfield OH 44905.* For info call *(419) 589–2415* after 4 PM EST.

FEB 16

MARLBORO, MA The Algonquin ARC will hold their Electronics Flea Market and VE Exams at the Marlboro Middle School Cafeteria from 10 AM–3 PM. Sellers set-up at 8 AM. Admission $2. Tables $10 in advance, $12 at the door. Wheelchair accessible. VE Exams start at 9 AM sharp. Pre-registration required. Send $4.95 check payable to *Mark Schneider WI1W, 14 Fuller Dr., Marlboro MA 01752. (508) 485–1857.*

RICKREALL, OR The Salem and Oregon Coast Emergency Repeater Associations will sponsor their 1991 Ham Fair at the Polk County Fairgrounds, beginning at 9 AM. Admission is $5 in advance, $6 at the door. Talk-in: 146.26/.86 repeater. Write to *1991 Salem Ham Fair, PO Box 784, Salem OR 97308*, or call *(503) 585–9554.*

FEB 16–17

SARASOTA, FL The Sarasota ARA will sponsor its annual Hamfest/Computer Show at the Robarts Sports Arena. Free parking. Forums. Saturday's activities include a tour to Jungle Gardens. There will be a banquet at 7 PM. VE Exams Sunday at 10 AM. Talk-in: 146.910 repeater. Contact *Gene Marino, 4858 Tivoli Court, Sarasota FL 34235. (813) 355–0675.*

FEB 17

MELVILLE, NY The Long Island Mobile ARC will sponsor a Hamfest indoors at Electrician's Hall from 9 AM–4 PM. Admission is $5 at the gate. Exhibitors, $20 by reservation only. Talk-in: 146.25/.85. Contact *Neil Hartman WE2V, (516) 462–5549* or *Mark Nadel NK2T, (516) 796–2366.*

GOLDEN, CO The Aurora Repeater Assoc. will hold it's 10th Annual Swapfest at the Jefferson County Fairgrounds from 8:30 AM–2 PM. Contact *Judi WD0HNP, (303) 450–6910* or *Jan KA7TYU, (303) 680–8857*, or write: *Aurora Repeater Assoc., PO Box 39666, Denver CO 80239.*

FEB 23

ORANGE, TX The Orange ARC will sponsor its sixth Annual Hamfest-Flea Market at the V.F.W. from 8 AM–4 PM. Set-up at 7 AM. Tables $5 for individuals, $15 for dealers. Talk-in: 147.180+. Contact *Sherwood Buckalew KA5VOT, (409) 883–6111*, or *Dan Killough WB4GYS, (409) 769–9603.*

BURLINGTON, KS The Neosho Valley ARC will sponsor an Electronics Hobbyist Auction at the National Guard Armory beginning at 10AM. Set-up at 8 AM. Free admission. There will be a 10% consignment fee on all items purchased. Talk-in: 146.52 MHz. Contact *Bob, (316) 364–5446* or write to *V.A.R.C., Route 2, Box 38, Burlington KS 66839.*

BROOKSVILLE, FL The Hernando County ARA will hold its ninth annual Hamfest at the Hernando County Fairgrounds on US Hwy. 41 from 8 AM–3 PM. Free parking. Tailgaters' area available. Overnight parking permitted, but there are no facilities. Admission $3 in advance, $4 at the door. AMSAT seminar begins at 10:30 AM. Talk-in: 146.715/.115. Send check and SASE to: *Hamfest Chairman, PO Box 1721, Brooksville FL 34605.* For info call *(904) 796–4840 after 7 PM.*

FEB 23–24

CINCINNATI, OH The ARRL '91 Lakes Division Convention will be held at the Cincinnati Gardens Exhibition Center from 8:30 AM–5 PM Sat. and Sun. Advance tickets $6 (by 2/16/91), $8 at the door. Set-up from Noon–11 PM Fri. and 6 AM Sat. and Sun. Flea market tables, 8' x 4½' $15 plus general admission. Commercial "A" tables, 8' x 9', $50 each. Commercial "B" tables, 8' x 4½', $25. Contact *Stan Cohen WD8QDQ, (513) 531–1011* or *Joe Halpin W8JDU, (513) 851–1056.* Accommodations: *Quality Inn Central, Norwood OH, (513) 351–6000.*

FEB 24

DEARBORN, MI The Livonia ARC will hold its 21st annual LARC Swap 'n Shop Computer Fest at the Dearborn Civic Center from 8 AM–4 PM. Buy or sell amateur gear, computers or electronic test equipment. Free parking. ARRL/VEC Exams will be given by the Motor City Radio Club. Exam reservation deadline is 2/4/91. Call *Don Olzewski WA8IZV, (313) 294–4766* for exam appointments. Reserved table space 8' minimum. Talk-in: 145.35 repeater (–600) and 146.52 simplex. Send 4x9 SASE to *Neil Coffin WA8GWL, c/o Livonia ARC, PO Box 2111, Livonia MI 48151.*

CUYAHOGA FALLS, OH The Cuyahoga Falls ARC will sponsor their 37th annual Hamfest at the St. V. Center from 7 AM–3 PM. Wheel chair accessible. Advance tickets $3, $4 at the door. Tables $5 in advance, $6 at the door. Sellers may bring their own tables. Talk-in: 147.25 repeater (+600). Contact *Bill Sovinsky KBJSL, 2305 24th St., Cuyahoga Falls OH 44223, (216) 923–3830.*

ROCK ISLAND, IL The Davenport ARC will celebrate its 20th year by hosting its 1991 Hamfest at the QCCA Expo Center. Doors open at 8 AM. Wheel chair accessible. For VE Exam info: *Al Broendel N9OK, 2712 38th St., Rock Island IL 61201.* Advance tickets $3, $4 at the door. Tables are $7 each. Contact *Dave Johannsen WB0FBP, 2131 Myrtle St., Davenport IA 52804.* Talk-in on the W0BXR 146.28/.88 repeater.

MAR 3

NORTHAMPTON, MA The Mt. Tom Amateur Repeater Assn. Fleamarket will be held at Smith Vocational School, starting at 9 AM. Set-up at 8 AM. Admission $2, under 12 free. Tables $12 advance, $15 at the door. Contact *Marvin Yale N1CDR, 6 Laurel Terrace, Westfield MA 01085, (413) 562–1027.*

MAR 9–10

CHARLOTTE, NC The ARRL Roanoke Division will hold the Charlotte Hamfest/Computerfair at the Charlotte Merchandise Mart. For information write to *Charlotte Hamfest & Computerfair, PO Box 221136, Charlotte NC 28222-1136.* To preregister call *(704) 536–7373.* For Dealer booth info contact *Robert Starling N4GVF, 7021 Holly Hill Rd., Charlotte NC 28227. (704) 568–7611.*

MAR 15–17

ORLANDO, FL The Orlando ARC will sponsor the Orlando HamCation and ARRL State Convention at the new Fairgrounds in Orlando. RV parking. Handicap parking. Advance tickets $6 (deadline Feb. 21st), $8 at the door. Swap tables $25. Tailgating $10. FCC Exams. For reservations: *The Orlando ARC, PO Box 547811, Orlando FL 32854-7811. (407) 657–9052.*

SPECIAL EVENT STATIONS

FEB 1–10

VERNON, B.C., CANADA The North Okanagan RAC will operate Station VE7NOR during the 31st annual Vernon Winter Carnival. Frequencies: 28.575, 14.275, 7.175 and 3.775. The "Winter Carnival Award" is free, but please send $1 or 2 IRC's (to cover the cost of postage) and either a QSL card or log info of a QSO with VE7NOR, to *Winter Carnival Award–VE7NOR, Box 1706, Vernon, B.C. V1T 8C3, Canada.*

FEB 2–3

VT QSO PARTY The Central Vermont ARC (W1BD) will hold a QSO party from 0001Z Feb. 2–2400Z Feb. 3. Frequencies: (Phone) 80–15 meters, the first 25 kHz up from the beginning of the General phone band edge; Novice 10 meter SSB portion. 50.110, 144.2. (CW) 3540, 3720, 7040, 7120, 14040, 21040, 21140, 28040. (RTTY) 3620 & 90 kHz from lower edge of other bands. Exchange–VT stations send RS(T) and CW two-letter county designators: AN, BN, CA, CN, EX, FN, GI, LA, OG, OL, RU, WA, WM, WR. Other stations send RS(T) and state, province, or ARRL country. Scoring–VT stations: 1 point per phone contact; 2 points per CW or RTTY contact. Multiply by number of VT counties plus states/Canadian provinces/ARRL countries (non-W/VE). Add 20 bonus points to total score for working W1BD. Other stations: 1 point per phone contact; 2 points per CW or RTTY contact. Multiply by number of VT counties. Add 20 bonus points to total score for working W1BD. Rules–A station may be worked three times per band; once each on Phone, CW, or RTTY sub-bands. No duplicate or repeater contacts. W1BD may be worked on each different band for bonus points; (Phone, CW or RTTY). Awards–Non-VT: Certificate to highest-scoring station in each state, province, country (non-W/VE). Vermont: Certificate to each station submitting a log. Plaque to highest-scoring VT station. Special certificates for highest scoring stations in CW, RTTY, HF Packet, SSTV, etc. W/VT Award to stations working 13 of Vermont's 14 counties. Send SASE now for official score and log sheets. SASE for results. Send logs/facsimilies, name, address, county (Vermont), NLT Mar. 1st, '91 to *D. Loverin WA1PDN, 50 Liberty St., Montpelier VT 05602* Note: 146.52 will be used for working VT counties at 9 AM and 9 PM EST, during the contest.

FEB 3

ANAMOSA, IA The Jones County ARC will operate Station N0CWP from 1200–1800UTC in celebration of the First Anniversary of the opening of the Lawrence Community Center. Phone and CW operation will be on the lower portions of the General sub-bands on 15, 20 and 40 meters, and the Novice portion of 10 meters. For QSL, send SASE to *N0CWP, Jim McClintock, PO Box 462, Morley IA 52312.*

FEB 9

AUSTIN, TX Station N5OWD will operate from 1400Z–2300Z to commemorate the 10th anniversary of The Armadillo BBS. Operation is in the Novice/Tech phone portion of 10 meters. For certificate, send QSL and SASE to *Ron Hawkins N5OWD, 1459 South Meadows, Austin TX 78758.* The Armadillo BBS, (512) 837–2003, answers 300–2400 baud callers and operates 24 hours a day in support of amateur radio/TV operators and others. It also contains a library of HAM-related files.

FEB 9–10

PHOENIX, AZ The Motorola ARC of Arizona will operate Station KB7FZC from 1500Z Feb. 9–0200Z Feb. 10, in commemoration of Arizona Statehood Day. The station will be based at Papago Park, near the tomb of George W.P. Hunt, First Governor of Arizona. Frequencies: CW–7.130, 14.050, 28.050; SSB–7.150, 14.280, 18.155, 21.380, 28.450 MHz. For an unfolded certificate, send a large SASE with your QSL card to *John Tucker KB7FZC, 2802 N. 34th St., Phoenix AZ 85008.*

FEB 11–15

NEW YORK The Fifth Annual School Club Roundup (formerly Operation SEARCH), is sponsored by the Council for the Advancement of Amateur Radio in the New York City Schools, the ARRL and its Hudson Division Education Task Force, to foster contacts with and among school radio clubs. The Contest will operate all week from 0800—2000 EST. Operate no more than 24 of the 60 hours. Logs must clearly show on and off times. Off periods must be at least 30 minutes. Classes: (I) Individual or Single Operator (non-club); (C) Club or group (non-school); (S) School Club or group (grades K–12). Exchange–Call sign, RS(T), class, US state or DX country. Scoring–No repeater contacts except satellite and "real time" packet. Stations may be contacted once each on phone and CW (Packet and RTTY count as CW). One point for each phone QSO. Two points for each CW QSO. Multiplier–Number of states plus DX countries plus 2x "C" class QSO's plus 5x "S" class QSO's. Final Score–Multiply QSO points by multiplier. Reporting–Sample log and entry forms are available for an SASE. Mail entries to *School club Roundup, c/o Lew Malchick N2RQ, Brooklyn Technical HS, 29 Fort Greene Place, Brooklyn NY 11217.* Logs must include exchange info, bands, and signature of all operators (and authorized club official or trustee). Dupe check sheets required for entries over 100 QSO's. Postmark by 3/18/91. Awards–Certificates for top three entries in each class. Special certificate for any station contacting ten or more school clubs. Send a large SASE or sufficient IRC's for complete results and more info about CAAR/NYCS.

FEB 14–17

LOVELAND, CO The Loveland Repeater Assoc. will operate Station KA0VFF (Valentines for Friends) from 1500–0500 UTC Feb. 16th and 17th, with some activity on Feb. 14th and 15th from 2500–0500 UTC. Frequencies: 25 kHz up from the lower portion of the General class phone and CW bands. Please QSL via *KA0VFF, Michael H. Walker, 3816 Ash Ave., Loveland CO 80538.* Send a SASE for your 8½" x 11" certificate commemorating Valentines Day from Loveland.

FEB 16–17

APACHE JUNCTION, AZ The Superstition ARC will operate Station WB7TJD in commemoration of Lost Dutchman Days from 1400Z–0200Z. Frequencies: 20, 15, and Novice section of 10 meters. Local contacts via 147.12 MHz. For special certificate and club QSL card, send 2 units postage on 8½" x 11" SASE to *SARC-WB7TJD, PO Box 1551, Apache Junction AZ 85217.*

FEB 22–24

WAIMEA, KAUAI The Kauai ARC will operate Station KH6HU from 2000Z Feb. 22–0600Z Feb. 24 to commemorate the landing of Captain James Cook. Frequencies: 25 kHz up on the General 80, 40, 20, 15, and Novice 10 meter phone bands. For certificate, send QSL and SASE to *KH6HU c/o KARC, PO Box 548, Kalaheo Kauai, HI 96714.*

FEB 22–MAR 10

FAIRBANKS, AK Station KL7KC will operate during the running of the Eighth annual Yukon Quest International Sled Dog Race. Frequencies: General portion of 80, 40, 20 and 15 meter bands; Novice portion of the 10 meter band. CW operation will be on or near 7.050, 14.050, 21.50, 28.200. QSL via *KL7KC, PO Box 81389, Fairbanks AK 99708.*

FEB 23

YUMA, AZ The Yuma ARES will operate Station N6RTV at 1500–2400 UTC to commemorate Amateur Radio Day 1991 in benefit of the International Red Cross. Frequencies: 10 meter Novice SSB–28.418 MHz; 15 meter General SSB–21.318 MHz; 20 Meter General CW–14.034 MHz. A unique certificate confirming communication with the internationally recognized Official Center of the World is offered to all amateurs submitting a QSL confirmation and 9" x 12" SASE to *Yuma ARES, c/o U.S. Post Office, Felicity CA 92283.*

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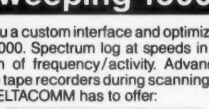

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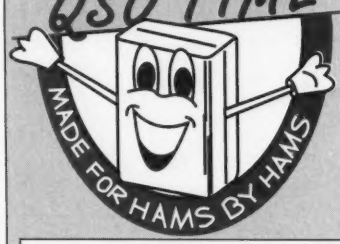

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Contains data on some 100 pirate stations active during 1989. How to tune in pirate broadcasts and get QSLs from the stations. **$7.95**

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Tune in thousands of Telephone, Data, Telex, Teletype, Facsimile Signals on most of the TV Satellites; plus all subcarriers. Covers equipment, hookups, where to tune. 234 pages. **$19.50**

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73T05 **"Genesis"** **$5.95**
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RANDOM OUTPUT

David Cassidy N1GPH

No Code

So . . . it's finally here. As we put the finishing touches on this issue, the FCC has announced the passing of a no-code license. Judging from what I've heard on the bands, most people are turning what is an elegantly simple solution to the no-code question into something much more complicated than it really is.

In a nutshell, here is the no-code license:

The no-code Technician license will retain all frequency privileges above 30 MHz (that's 6m, 2m, 220, 440, 1.2, etc).

The Technician test will consist of 55 questions.

Technicians will be given Novice HF privileges upon completion of a 5 wpm code test, administered by three volunteer examiners (the same way all upgrade tests are administered).

There is no change in any other license class. The Novice test and privileges stay the same, as do the General, Advanced and Extra. If a Technician wishes to obtain a General Class license, he would be required to take the 13 wpm code test, as well as the general written exam.

There will be no special call sign designation for no-code Technicians.

Current Technicians keep all HF privileges.

I must applaud the FCC for this simple solution to what has been an ongoing pain in the butt for them. It's a solution that makes an incredible amount of common sense. Coming from a government agency, I am stunned! Maybe we ought to let the FCC handle the deficit!

True to form, the ARRL is questioning the wisdom of letting these no-code Techs have 2 meter privileges. This smells of elitism on the part of the League (i.e., "Let's save 2 meters for us 'real' hams and put the no-code crowd up above 220 MHz, where we don't have to associate with them.") It also sounds like the League is a bit miffed over the fact that the FCC didn't adopt their idiotic and complicated proposal. Alas, the League's reaction is what we've come to expect from those old do-nothings in Newington.

Many hams are still bellyaching over this no-code license. Many still think that a code test keeps out the riffraff. People who use this argument must not spend too much time operating. Just listen to 75m phone some evening. How about the rude and discourteous operators on 10m, especially during contests? Let's not ignore the never-ending tirades of the looney tunes on 14.313. (At this point, don't you want everybody involved in that childish, egotistic baloney to just shut up?) A few of the 14.313 morons have made their way down to 40m, too. Since they all use callsigns, we may assume that they all have taken a code test. So much for the code keeping out the riffraff.

There's a whole other contingent (headed up by our buddies down in Newington) who don't mind having a no-code class of license—but put them up above 220 MHz (which translates into "keep 'em off of 2 meters"). With about two minutes of brain warming you can figure out how destructive this course would be. The only way to teach a new ham how to operate is to put him on the bands with other hams. If we put all no-code licensees up above 220 MHz, far away from the bulk of most amateur operating, it wouldn't be long until they became a separate group with their own way of doing things. This wouldn't necessarily be a bad thing, but it could degenerate into another CB-like situation. It is much better to put these new no-code licensees right on the most popular band—2 meters—and let them learn proper amateur operating practices (of course, this assumes that there are proper amateur operating practices on 2 meters for these new people to emulate).

Another complaint I've heard is that 2 meters is too crowded already. This new no-code license will just make it more crowded. Again, fire up those brain cells and you will soon realize how absurd this statement is. Sure, we have wall-to-wall repeaters on 2 meters. The entire North American continent is full of 2 meter repeaters. People who want to set up a repeater on 2 meters generally must wait for the owner of a current repeater to die before a frequency pair becomes available. The only problem is that most of these repeaters are silent. Nobody's using them!

Sure, every area has its most popular repeaters. Large population areas may have several well-used repeaters. Still, I defy you to prove that every repeater we currently have in operation in this country is being used. Even in major cities you can scan through dozens of repeaters and not hear a single voice for most of the day. We could quadruple the number of hams on 2 meters, and there'd still be room enough for everyone (unless you're a snob and don't want anyone but your little group of buddies to use your repeater).

Let's face it, folks. It's about time that amateur radio entered the '80s (I know it's 1991, but we must take it a step at a time). Morse code is a really fun way to communicate, but it is only one way, and not a very efficient way at that. What would you say if we required all licenses to be tested in SSTV . . . or RTTY . . . or packet . . . or EME moonbounce? They're all valid modes of communication. Why should we hang onto this antiquated mode of communications as an entry requirement? Most of us lose what little code proficiency we have 10 minutes after taking our test, so what's the point?

The question of no-code has been argued back and forth for over 10 years. We've all had our say. We've all heard just about every argument for and against. The FCC, after considering every viewpoint, has finally come up with a no-code license, and miracle of miracles—it makes sense! The time for arguing is now over.

Will a no-code license, by itself, be the salvation of amateur radio? No. Just about everyone who wants a ham ticket has been able to get one. Sure, we'll increase our numbers by a few percent, but will we see a surge of interest in this hobby? It's not likely. The problem has never been that people who want to be hams can't pass the code requirement. The problem is that most people have absolutely no idea what amateur radio is. It's a marketing and public relations problem.

Let's use this new license as a way to introduce amateur radio to the thousands of people we need to keep this hobby viable. Once we get 'em on 2 meters, let's get 'em hooked on HF so that they'll be motivated to learn the code and upgrade. The FCC has provided us with a great marketing tool. It's up to us to use it to our advantage. 73

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 E. Chateau Circle
Payson AZ 85541

An Unpredictable Cycle

Old Sol fooled us again! For the past several months, we have been commenting about how the sun had apparently reached a plateau, and might even be headed down again . . . when surprise, surprise! During August 1990, the highest observed mean sunspot number of 200 for this cycle was noted, and the solar flux index reached a fantastic 295, marking an all-time high for Cycle 22.

At the time of this writing, in November, no one can predict for sure what the sun will do next. It may start down, go up, or stay constant. Whatever your favorite view, it's easy to say that Cycle 22 has been the most unusual cycle observed for at least a century.

Now: February's dismal prognostication. There will be some good days, around the 10th and the 23rd, when the HF bands will be jumping with signals for a few days. Otherwise, conditions will be "Fair" trending toward good or poor, as the chart shows.

Your best bet will be to consult WWV for the daily forecast at 18 minutes past each hour to get a better idea of solar flux and magnetic field conditions. You can expect "Good" conditions when the magnetic field "A" index is 10 or below, and the solar flux index is 175 or higher. Trends toward *lower* "A" numbers and *higher* solar flux numbers mean a trend to good DX.

February, as a pre-spring month leading to usually peak-DX conditions in March, will be a good one to watch. March should be the best DX month for all of 1991, and February might well turn out better than predicted. Let's hope so . . . 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	–	20(*)	20(*)	–	20(*)	20(*)	–	10(*)	–	15
ARGENTINA	15/16	40/(*)15/16	15/16	20(*)	–	–	–	–	10	10	10	15
AUSTRALIA	20/(*)15/(*)	–	–	20(*)	40(*)	20	20	20/(*)	–	20(*)	20/(*)	
CANAL ZONE	15	20	20	80	–	40	–	10	10	10	10	10
ENGLAND	40	40/80	40/80	40/80	40	–	–	20/15	20/15	15	20	40
HAWAII	15/(*)10	20	20	20	20	40	–	20/(*)15	–	–	20/(*)10	
INDIA	–	20(*)	20(*)	–	–	–	20(*)	15(*)	–	–	–	–
JAPAN	15	20	–	20(*)	20(*)	–	20(*)	20(*)	–	10(*)	–	15
MEXICO	15	20	20	80	–	40	–	10	10	10	10	10
PHILIPPINES	15(*)	–	–	–	–	–	20(*)	20(*)	20/(*)	–	–	–
PUERTO RICO	15	20	20	80	–	40	–	10	10	10	10	10
SOUTH AFRICA	20	40(*)	–	–	–	–	–	–	10	10	10/20	20
U.S.S.R.	–	–	–	–	–	–	–	20/15	20/15	10/20	–	–
WEST COAST	15/20	30/15	15	40	40	40	–	–	30/15	10	10	10

CENTRAL UNITED STATES TO:

ALASKA	20/(*)15/(*)	–	–	20(*)	–	–	20(*)	–	–	–	–	–
ARGENTINA	20	20	20	20	20	–	–	–	–	10	15/10	15/10
AUSTRALIA	10(*)	–	–	–	–	40(*)	40(*)	20	20/(*)	15	15	15
CANAL ZONE	20	20	80/20	80/40	40	40	–	15/20	20/15	20/15	20/15	15
ENGLAND	40	80/40	80/40	80/40	–	–	–	20/15	20/15	20/15	20/15	20
HAWAII	15/20	20	20	20	20/15	20/15	40	20	–	15	–	15/20
INDIA	20(*)	15(*)	20(*)	–	–	–	20(*)	20(*)	–	–	–	–
JAPAN	20/(*)15/(*)	–	–	20(*)	–	–	20(*)	–	–	–	–	–
MEXICO	20	20	80/20	80/20	40	40	–	15/20	20/15	20/15	20/15	15
PHILIPPINES	10(*)	30/15(*)	–	–	–	–	–	–	20	20	–	–
PUERTO RICO	20	20	80/20	80/20	40	40	–	15/20	20/15	20/15	20/15	15
SOUTH AFRICA	20	80/20	–	–	–	–	–	–	20/15	20/15	15	15(*)
U.S.S.R.	–	40(*)	40(*)	20(*)	20(*)	–	–	15(*)	10(*)	20	–	–

WESTERN UNITED STATES TO:

ALASKA	*	*	–	–	–	–	40	40	–	–	20	30/15
ARGENTINA	10	15	20	40/20	20/15	20	–	–	–	15	10	10
AUSTRALIA	10	20	20	–	–	–	40	–	–	15	–	–
CANAL ZONE	20	30/40	30/40	40/80	40	–	–	30/15	10	10	10	15
ENGLAND	–	–	–	40(*)	40(*)	20(*)	–	–	40/20(*)	30/15(*)	20	20
HAWAII	15	15/20	15/20	20	–	40(*)	40	–	–	15	10(*)	10
INDIA	–	30/15(*)	20(*)	–	–	–	–	–	20(*)	–	–	–
JAPAN	**	**	–	–	–	–	40	40	–	–	20	15/20
MEXICO	20	30/40	80/40	80/40	80/40	40	–	–	30/15	10	10	15
PHILIPPINES	10	15	–	–	–	–	–	–	20	20	20	15
PUERTO RICO	20	30/40	30/40	80/40	80/40	40	–	–	30/15	10	10	15
SOUTH AFRICA	20	20	20(*)	–	–	–	–	–	–	10(*)	20/15	15
U.S.S.R.	–	–	–	40(*)	20(*)	20(*)	–	–	15(*)	20	–	–
EAST COAST	15/20	30/20	15	40	40	40	–	–	30/15	15/40	*	*

*Notes: The bands shown are likely to represent the highest frequency available to the desired areas at the time shown. Work from there to a lower frequency band when the higher frequency band is not open. (1) Rare, and only on a "good" day. Blank spaces (–) mean the path is not workable at that time. * 15/10/20; ** 10/15/20*

FEBRUARY 1991

SUN	MON	TUE	WED	THU	FRI	SAT
					1 P–F	2 F
3 F	4 F–P	5 P	6 P–F	7 F	8 F–G	9 G
10 G	11 G–F	12 F–P	13 P–F	14 F	15 F	16 F–P
17 P	18 P	19 P–F	20 F	21 F–G	22 G	23 G–F
24 F–P	25 P–F	26 F	27 F–G	28 G		

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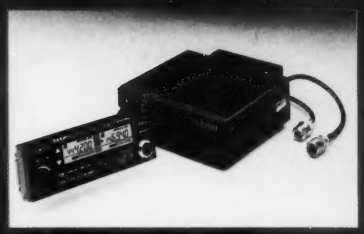

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